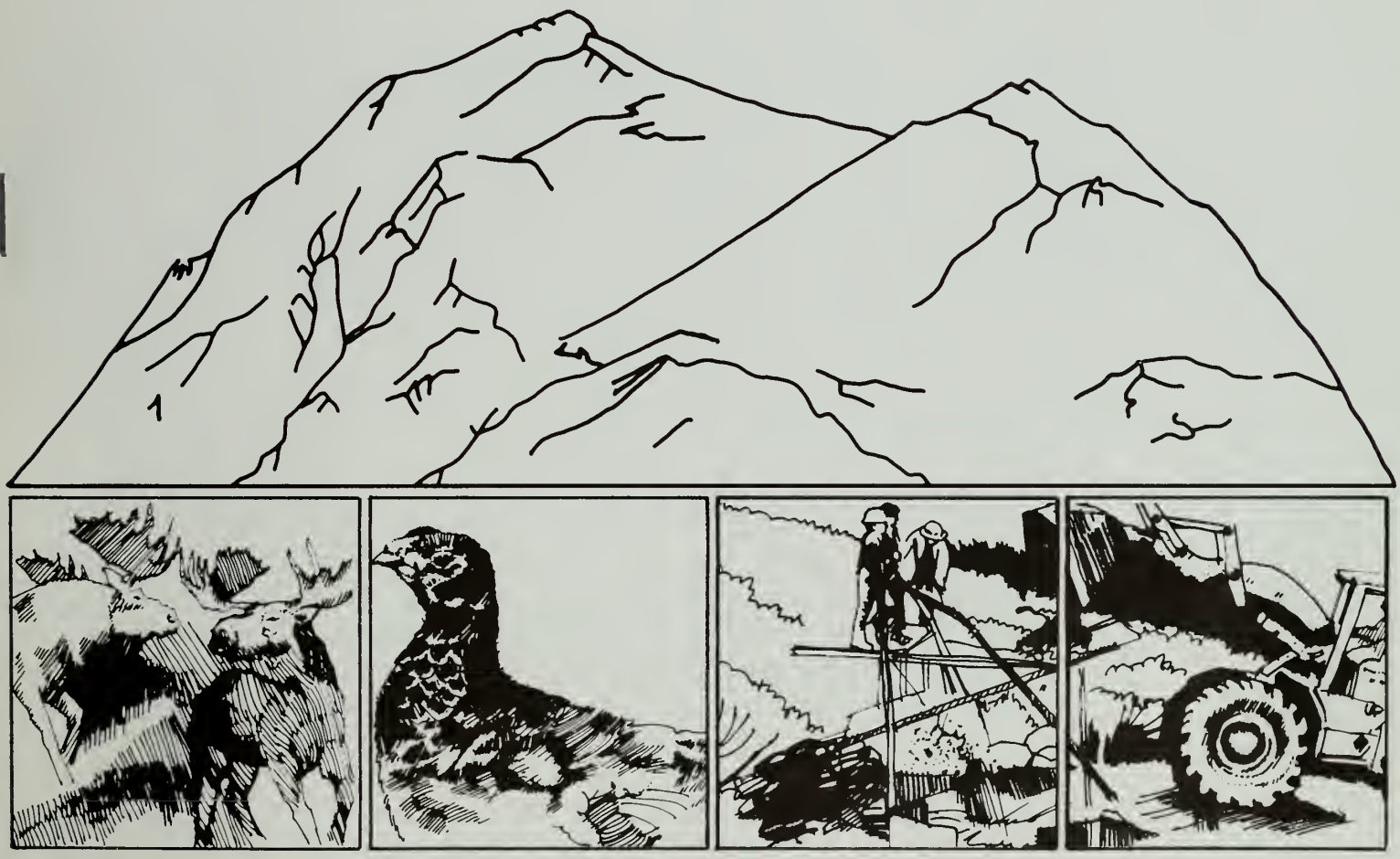
Kantishna Hills/ Dunkle Mine

Study Report



Alaska Land Use Council
May 1984

KANTISHNA HILLS/ DUNKLE MINE

Study Report

This report was prepared by the Kantishna Hills/Dunkle Mine Study Group. The report was submitted to the Alaska Land Use Council on May 23, 1984. The Council concurred with and accepted the report and directed that it and the environmental impact statement prepared by the National Park Service be transmitted to the Secretary of the Interior.

TABLE OF CONTENTS

KANTISHNA HILLS/DUNKLE MINE STUDY REPORT

I. INTRODUCTION

Pursuant to Section 202(3)(b) of the Alaska National Interest Lands Conservation Act (ANILCA; PL 96-487) as enacted on December 2, 1980, the Alaska Land Use Council, in cooperation with the Secretary of the Interior, is charged with the responsibility of conducting a study of the Kantishna Hills and Dunkle Mine areas in Denali National Park and Preserve. The study and resultant report "shall evaluate the resources of the area, including but not limited to, fish & wildlife, public recreation opportunities, wilderness potential, nistoric resources, and minerals, and snall include those recommendations respecting resources and other relevant matters wnich the council determines are necessary." The Land Use Council is further instructed to "compile information relating to the mineral potential of the areas encompassed within the study, the estimated costs of acquiring mining properties, and the environmental consequences of further mining."

In fulfilling this obligation to Congress, the Alaska Land Use Council designated the Alaska Department of Natural Resources and the National Park Service as co-leaders for the Kantishna Hills/Dunkle Mine Study project. Other member agencies of the study group are: the Alaska Department of Environmental Conservation, the Alaska Department of Fish & Game, the U.S. Bureau of Mines, the U.S. Geological Survey, and the U.S. Fish & Wildlife Service. As directed by the Alaska Land Use Council and in conjunction with other state and federal agencies the study group has conducted the appropriate studies.

This report and documents listed in Appendix I to this report constitute the products of the study and the recommendations of the Alaska Land Use Council.

The National Park Service is responsible for the preparation of the environmental impact statement for the study report.

II. STUDIES CONDUCTED

The studies conducted address mineral potential and feasibility of mining, mining claim acquisition costs, natural and mining-impacted water quality, fish and wildlife values, cultural resource values, and recreational and wilderness resource values. Findings of the studies are briefly summarized below:

° Mineral Potential-

The Alaska Division of Geological & Geophysical Surveys Report of Investigation 83-12, "Mineral-Resource Modeling, Kantishna (Hills)-Dunkle Mine Study Areas, Alaska", published in May, 1983, sets forth the basic geologic framework and mining nistory of the two areas, and, using half-square modeling techniques, estimates remaining ore reserves in the two areas. The reader is referred to the executive summary of that document in Appendix II.

A $1.6 million contract to perform mineral resource studies in the two areas during the summer of 1983 was let by the U.S. Bureau of Mines. The mineral assessment conducted under this contract has determined that the Kantishna Hills Study Area is a rich mineral district with known deposits of placer gold and lode gold, silver, antimony, tungsten and other base metals and good potential for additional deposits. The Dunkle Mine Study Area appears to have good potential for lode deposits of copper, molybdenum and gold and moderate potential for placer gold deposits of small to moderate size. The Dunkle Mine Study Area also contains known moderate-sized subbituminous coal reserves. A summary of the results of the mineral assessment study are included as Appendix III.

A likely mining development scenario for the Kantishna Hills was prepared by the U.S. Bureau of Mines with aid of the U.S. Geological Survey, the Alaska Department of Natural Resources, and private contractors who had worked in the area. Appendix IV contains a summary of the likely mining activity both on currently claimed lands and on other lands if they were made available to mineral entry.

Mineral resource endowment of the two areas was estimated by the Alaska Division of Geological and Geophysical Surveys. The total recoverable value of known and undiscovered mineral resources in the Kantishna Hills Study Area ranges from 375 to 1,210 million dollars at the 95 percent and 5 percent confidence levels, respectively. In the Dunkle Mine Study Area, excluding coal resources, the values range from 0 to 840 million dollars at the 95 percent and 5 percent confidence levels, respectively. A summary of these results are included as Appendix V.

◦ Mining Feasibility Studies-

Feasibility studies conducted by the U.S. Bureau of Mines indicate that development of model mineral deposits of commodity, grade, and tonnage similar to deposits found in the Kantishna Hills Study Area would present marginal to highly profitable investment potential, depending on the type of deposit, market conditions, and overall operating costs. See Appendix VI.

◦ Claim Acquisition Costs-

In order to satisfy the particular ANILCA mandate to determine the claim acquisition costs, a $60,000 contract was let by the U.S. Bureau of Mines. Results of this work indicate an estimated acquisition cost on the order of $157,200,000 for purchasing 185 unpatented placer and 5 unpatented lode claims and 34 patented lode claims in the Kantishna Hills area and 9 unpatented placer claims in the Dunkle Mine Study Area.* Surface values of the patented claims are included in the above figure. Any acquisition costs of 12 unpatented placer, 80 unpatented lode claims and the University of Alaska owned Stampede claims in the Kantishna area are not included in the above figure. An estimate of acquisition cost of 142 unpatented lode claims in the Dunkle Mine Study area is $29 million to $60 million. Appendix VII outlines the findings of this contract in greater detail.

* Only claims assumed to be valid in the draft EIS were addressed by this study. Additional potentially valid claims were not included.

° Water Quality - Heavy Metals -

Studies performed by the U.S. Fish & Wildlife Service (USFWS) with financial assistance from the National Park Service have shown most streams sampled in the Kantishna Hills area to be high in metal content, with generally higher metal contents below mining operations. Sampling of fish (grayling) tissue and specific organs also showed anomalously high results. A summary of the USFWS study is included in Appendix VIII.

° Mining Impacted Water Quality-

Water quality studies performed by the Alaska Department of Environmental Conservation (DEC) determined that the waste water being discharged by many placer mining operations in the Kantishna Hills is exceeding state water quality standards greatly in excess of attainable levels. Further discussion on the DEC studies are included in Appendix IX.

° Fishery Research-

Fisheries research in the Kantishna Hills Study Area by the National Park Service and the Alaska Department of Fish & Game found arctic grayling, slimy sculpin, round whitefish, chinook salmon, coho salmon, and chum salmon. Salmon are found in the Bear Paw River, Glacier Creek, Caribou Creek and Moose Creek and Toklat River drainages. Arctic grayling are distributed throughout the area with grayling abundance higher in streams which have not been subjected to mining. Appendix X contains more detailed data on the fishery resource studies.

° Wildlife Research-

A study of terrestrial vertebrates by the National Park Service confirmed caribou, moose, brown bear, and wolf as the prominent species present in the Kantishna Hills. Furbearers and raptors were also reported. Comparison of an unreclaimed area on Caribou Creek which was mined in the 1930's to a natural area demonstrated significantly higher use by birds and mammals of the unmined area. Appendix XII contains additional data on the wildlife resources of the Kantishna Hills area.

The National Park Service conducted surveys of caribou use in the Dunkle Mine Study Area and surrounding lands. The Denali caribou herd uses the southern flanks of the Alaska Range, including the Dunkle Mine Study Area, in most years for calving and post calving activities. In recent years most intense use has occurred to the north of the study area, with decreasing use to the south, across the Dunkle township. Appendix XIII contains additional discussion of the Dunkle caribou studies.

No listed, proposed, or candidate threatened or endangered species are known to occur in either of the two study areas.

° Cultural Resource Values-

Historic resources of the Kantishna Hills Study Area include various pieces of equipment and structures left from early mining in the area. Two prehistoric sites have been identified immediately north of Moose Creek at Rainy Creek and Willow Creek.

Historic resources in the Dunkle Mine Study Area include buildings remaining from the Dunkle Coal Mine which last operated in the 1950's and older cabin ruins. No prehistoric sites have been found at Dunkle despite testing at promising areas.

Summaries of the cultural resource studies are contained in Appendix XIV.

◦ Recreational Resources-

A report by the National Park Service (Appendix XIV) concludes that there is limited recreational use of the two study areas. Most recreational use in Kantishna in recent years has been associated with two small lodges in the area. Recreational opportunities there include hiking, fishing, and gold panning, although most visitors to the National Park are more attracted to the open tundra areas to the south of the Kantishna Hills within the former Mt. McKinley National Park. The Dunkle Mine Study Area offers opportunities for hiking and camping. It is estimated that fewer than 10 recreationalists per year visit the Dunkle Mine Study Area.

◦ Wilderness Resources-

A report by the National Park Service on the technical suitability of the study areas for wilderness designation (see Appendix XV) provided the following information: Pursuant to the criteria set forth in the Wilderness Act of 1964, approximately 70% of the Kantishna Hills Study Area and 85% of the Dunkle Mine Study Area are currently suitable for wilderness designation. These percentages of the study areas are "undeveloped federal land retaining their primeval character ... , without permanent improvements of human habitation ..." and also currently meet the other four criteria established by the Wilderness Act.

III. NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE (ENVIRONMENTAL IMPACT STATEMENT)

Because recommendations to the Alaska Land Use Council and Congress contained in this study report could potentially result in legislation or major federal actions that could significantly affect the quality of the human or natural environments, the Department of the Interior, in consultation with the Alaska Land Use Council, determined that an environmental impact statement should be prepared pursuant to section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969 (42 USC 4332).

The National Park Service, Department of the Interior, was designated the lead agency for the preparation of the environmental impact statement (EIS). In preparation of the EIS, the Park Service has been assisted by the U.S. Bureau of Mines, the U.S. Fish & Wildlife Service, the U.S. Geological Survey, the Alaska Department of Natural Resources, the Alaska Department of Environmental Conservation, and the Alaska Department of Fish & Game.

IV. OVERVIEW OF THE KANTISHNA HILLS AND DUNKLE MINE STUDY AREAS-

The Kantishna Hills and Dunkle Mine Study Areas are located in the U.S. Geological Survey's Mt. McKinley and Healy (1:250,000-scale) quadrangles. They flank the former Mt. McKinley National Park along its north and southeast boundaries respectively, and currently lie within the Denali National Park and Preserve.

The Kantishna Hills Study Area is part of the low, rugged Kantishna Hills that are separated from the higher terrain of the Alaska Range by the Clearwater Fork of the Toklat River. The region is bordered on the west and northwest by the Kantishna-McKinley River basins. Elevation in the study area ranges from 1,600 ft along lower Moose Creek to 4,982 ft on Kankone Peak.

The rugged nature of the Kantishna Hills is, in part, a result of rapid uplift of the area during late Quaternary time. The northeasterly trend of the region parallels the structural grain of basement metamorphic rocks (fig. 2). Headwater portions of streams such as Glacier, Rock, Caribou, and Flume Creeks flow in rugged 'V-shaped' canyons and parallel the northeast-southwest bedrock structure. These streams swing north into broader meandering valleys subsequent to leaving the hills.

Timberline varies from 1,900 to 2,500 ft in elevation and reaches maximums in the hills west of the Toklat River and in sheltered valleys of the Canyon Creek drainage. Vegetation consists of white and black spruce sometimes intermixed with alder in areas with adequate drainage. Widely scattered birch and aspen stands are located in very well drained south-facing hills. Thick patches of willow and alder grow on active flood plains and in areas of former placer-mining activity. Moist tussock tundra covers broad, near-horizontal surfaces underlain by Tertiary sedimentary rocks and other poorly drained areas.

The climate of the Kantishna Hills Study Area is generally continental, but varies somewhat from north to south due to the influence of the Mt. Denali rain shadow and the gradual gain in elevation from north to south. The mean daily minimum temperature in January varies from -22° to -30°C (north to south), while the mean daily maximum temperature in July is 20°C. Average annual rainfall varies from 12 to 15 in. (north to south). Permafrost is extensive, and is absent only in active flood plains and on south-facing slopes.

Primary access to the area is via the Denali Park Road that stretches 94 miles through Denali National Park and Preserve from the Parks Highway to the Kantishna airstrip on the flood plain of Moose Creek. Approximately 25 miles of unmaintained roads and all terrain-vehicle trails branch from this road and provide access to mines and prospects on Glacier, Caribou, Glen, Spruce, Eldorado, and upper Eureka Creeks. A 60-mi-long winter trail was constructed in 1936 from Kobe on the Alaska Railroad to Stampede to haul high-grade antimony ore from the Stampede Mine. Parts of this trail were improved by the Alaska Road Commission in 1960 to provide a transportation corridor into the Kantishna mining district. However, construction work was eventually suspended and the road remains partially overgrown and unused. Available

gravel (and in some cases unmaintained) airstrips include those at Stampede, Friday Creek, Crooked Creek, Glen Creek and Caribou Creek. Principal human activities include mining and recreation.

The Dunkle Mine Study Area lies in the West Fork Chulitna River drainage on the southeast flank of the central Alaska Range. Rounded aligned hills and 'U-shaped' valleys that range from 2,000 to 3,200 ft in elevation are the result of extreme glacial scour during the Wisconsian time (10,000 yr. B.P.). Bedrock colluvium is mixed with till in many areas. Stands of spruce, birch, and alder are confined to valley floors below 3,000 ft elevation, and scrub brush is present at higher elevations.

The Dunkle Mine Study Area is located approximately 8 miles west of the Colorado railhead and the Parks Highway. Overland access consists of a poorly maintained road built to service the W.E. Dunkle Coal Mine and Golden Zone (copper-gold) Mine. Three major bridges on this road are currently in a state of disrepair. Several short (Ä 2,000 ft) gravel airstrips are located on the flood plain of the Chulitna River, on isolated ridge tops, and at the Dunkle Coal Mine.

The Denali Caribou Herd inhabits areas of the southern flanks of the Alaska Range, a portion of which extends across the Dunkle township. The geographical center of calving and post-calving activity in recent years has been just to the north of the Dunkle township; caribou use of the Dunkle township has been most intense in the northwest corner with decreasing amounts of use towards the southern end of the township, although use does occur across the entire township. In recent years no caribou have been observed in the southern third of the township.

Historical Uses

Placer gold was first discovered in the Kantishna Hills by Judge James Wickersham while enroute to his unsuccessful bid to climb Mount McKinley in 1903. A small gold rush followed, involving several thousand miners, most of whom left by 1906. Discovery of lead, antimony, and other sulfide cobbles caught in placer mining sluice box riffles prompted exploration for hard-rock deposits and led to the first shipment of antimony from the area in 1905. By 1919 numerous mineralized veins had been discovered containing antimony, silver, lead, zinc, gold, copper, arsenic, and tungsten in a 40-mile belt extending from Slate Creek to Stampede. Silver production continued in the Quigley Ridge area in the 1920's and gold, silver and base metals were produced from the Banjo Mine in the late 1930's and early 1940's. Antimony has been sporadically mined from the Last Chance, Eureka, Slate Creek and Stampede deposits, primarily during high price levels of World Wars I and II and the Korean and Vietnam conflicts. Placer gold mining in the area has been continuous since discovery and has increased substantially in the past few years. Total mineral production of the Kantishna Hills is estimated at 85,500 oz. of gold, 270,000 oz. of silver, 5 million lb. of antimony, and several million lb. of lead and zinc.

The presence of mineralization in the upper Chulitna district, including the Dunkle Mine Study Area, was first noted when the area was intensely prospected for gold from 1911 to 1915. Coal was found in the Dunkle area and was used by early prospectors and miners. In 1941 increasing demand for coal

by the government led to development of the Dunkle and other coal seams on upper Costello Creek. By 1943 over 5,000 tons of coal had been mined and shipped to military installations in southcentral Alaska. By 1954 an estimated 59,000 tons had been mined. Prospecting in the 1960's and 1970's led to the discovery of several base-precious metal prospects in the Dunkle townsnip.

Present Human Uses-

Present uses of the Kantishna Hills area include 15 to 25 placer gold operations and two small-scale lode mining operations, tourism, subsistence hunting and trapping, hiking, and fishing. Present uses of the Dunkle Mine Study Area include minor activity associated with existing mining claims and low levels of recreational use. These uses are evaluated in greater detail in the environmental impact statement.

V. ALTERNATIVE MANAGEMENT OPTIONS - KANTISHNA HILLS AREA

Seven alternative management options for the Kantishna Hills Study Area were formulated by the Kantishna Hills/Dunkle Mine Study Group to represent the full range of reasonable alternatives for mineral development and protection of park resources in order to meet the legislative mandate of ANILCA and NEPA. The alternatives address a spectrum of reasonable possibilities, ranging from precluding mining within the study area by purchasing all claims to reopening areas of significant mineralization for mineral development by removing them from the park.

Brief summaries of the seven alternative management options for the Kantishna Hills Study Area are presented below. The alternatives are discussed in greater detail in the environmental impact statement.

Alternative 1 - Implement Mineral Leasing Program (Preferred Alternative)

Under this alternative, those portions of the Kantishna Hills Study Area identified as having known or suspected significant minerals resources would be open for disposition under a mineral leasing program administered by the National Park Service. No surface or subsurface estate ownership would be transferred from the federal government under the leasing program. Prior valid rights would be protected. Existing and future mining operations and related activities could continue on valid unpatented and patented claims. The National Park Service would develop regulations to control leasing activities, policy to govern mineral leasing in national park areas, and a mineral management plan to direct the leasing program.

The mineral leasing program would be implemented in federal fiscal year 1989, if by that time operators on existing placer claims in Kantishna are meeting applicable water quality standards and stipulated reclamation requirements. Compliance with water quality standards would be a necessary prerequisite for approving future mining plans of operations. Operations not capable of achieving compliance with water quality standards, or otherwise protecting park resources would not be permitted.

Section 206 of ANILCA closed the park to further mineral entry and location including mineral leasing. The National Park Service is not authorized to lease minerals except as specifically authorized by Congress. Therefore, implementation of this alternative in the Kantishna Hills would require an act of Congress.

Approximately 114,535 acres (59%) of the 194,968 acres Kantishna Hills Study Area contain significant mineral resources or have potential for significant mineral resources. However, because 7,100 acres are overlain with recorded patented and unpatented placer and lode claims, only 107,435 acres, or approximately 55 percent of the study area, would be opened to mineral leasing.

Of that total, 52,599 acres in the Clearwater Fork drainage, or approximately 27 percent of the Kantishna Hills Study Area, would be opened for the leasing of lode mineral deposits only. No leasing of placer deposits or placer mining would be allowed in this area due to concerns for fish and other resources in that drainage. The remaining 54,836 acres, or approximately 28 percent of the study area, would be opened for the leasing of both placer and lode deposits. (See Figure 1).

Alternative 2 - Maintain Status Quo (No Action)

This alternative would allow mining operations and mining-related activities to continue on existing patented and valid unpatented placer and lode claims. In addition, subject to approved plans of operations, mining activities could commence on previously undeveloped patented and valid unpatented claims.

Mineral development and mining activities would continue to be managed under existing regulations of the National Park Service and other authorities, general and specific park stipulations, and normal permitting and approval requirements of other regulatory authorities. These activities, including adequate and feasible access, would continue to be subjected to approval of mining plans of operations, with regard to protection of natural and cultural resources and other park values, and to a determination of claim validity. Pursuant to standard claim validation procedures, those unpatented claims deemed invalid would revert to public park status, and any mining operations and related activities associated with these claims would be terminated.

Claim acquisition would occur only on a willing seller - willing buyer or donation basis except in those cases where it could be determined that mining would significantly and adversely affect park lands. Acquisition of mining claims other than by donation would be subject to the appropriation of funds.

Alternative 3 - Acquire All Mining Claims

All patented and valid unpatented mining claims in the Kantishna Hills Study Area would be acquired by the federal government under this alternative. Unpatented claims would be subject to adjudication of validity prior to purchase.

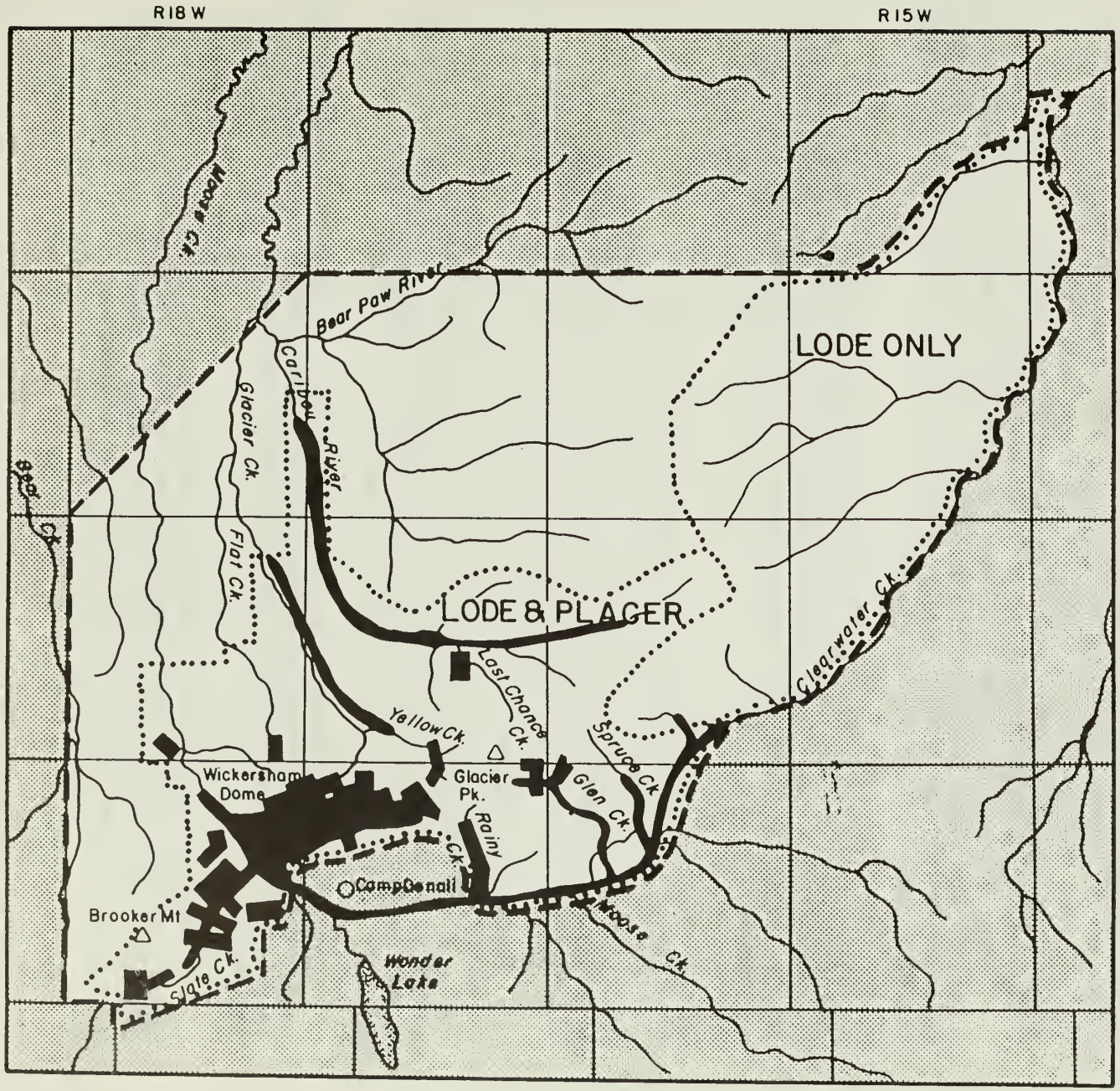


Figure 1.

area recommended for locatable mineral leasing.

Kantishna Hills Study Area.

mining claims.

Alternative 4 - Offer Term Operating Rights

Under this alternative, claimants holding unpatented placer or lode claims or claim groups, which had proven production on or before December 2, 1980, could elect the right to operate on the claims or claim groups for 25 years. No validity determination would be made by the government on these claims. The right would expire at the end of the 25-year period or upon the claimant's death, whichever occurred first. In addition, the right to operate would terminate if there were no proven production within 5 years following election of this right or if there were a lapse in proven production for two consecutive seasons thereafter. An Act of Congress would be required before this alternative could be implemented.

Alternative 5 - Allow Additional Time for Perfecting Claims

Under this alternative all claimants holding unpatented placer and lode claims in the study area that are unperfected would be granted an additional 5 years to explore and achieve a valid mineral discovery within the meaning of the mining laws of the United States.

If the claims are determined to be valid, mining operations could proceed, subject to NPS regulations. If the claims cannot be perfected and are determined to be invalid, the claims would revert to public park status. An Act of Congress would be required before this alternative could be implemented.

Alternative 6 - Expand Mineral Development Possibilities

In this alternative, those portions of the Kantishna Hills Study Area with known or suspected significant mineral resources would be opened to mineral entry and location under the mining laws of the United States.

Those areas containing significant metalliferous minerals could be opened to mineral entry and claim location for 15 years under the Mining Law of 1872. All provisions of the 1872 Mining Law would apply except any patent issued would convey title to the subsurface estate only. The surface estate of all lands open to mineral entry would remain in federal ownership and continue to be administered by the National Park Service.

Entry, claim location, recordation and annual filing activities would be managed pursuant to existing BLM regulations (43 CFR 3800). All mining operations, activities and surface uses would be subject to NPS regulations (36 CFR 9A).

Prior valid rights would be protected, and existing and future mining operations and related activities could continue on existing valid unpatented and patented mining claims in the Kantishna Hills. An Act of Congress would be required before this alternative could be implemented.

This alternative would open approximately 107,435 acres of land in the Kantishna Hills Study Area to mineral entry and location. This acreage is the area of significant metalliferous mineralization that is not presently overlain with existing lode and placer claims. The total area open to mineral entry, including the 7,100 acres of existing claims, would be 114,535 acres.

Alternative 7 - Remove Mineralized Areas From The Park

In this alternative, the existing park boundary in the Kantishna Hills Study Area would be adjusted to exclude significantly mineralized lands. A land exchange with the State of Alaska or other federal agencies (for other areas of significant natural, cultural, or recreational values outside the park) would be a condition of removing these areas from the park.

Specific land exchange possibilities would be subjected to further analysis and negotiations between the State of Alaska or other federal agencies and the Department of Interior. Portions of the Kantishna Hills Study Area which could be considered for exchange involve approximately 114,535 acres.

An Act of Congress would not be required to implement this alternative because pursuant to section 103(b) of ANILCA, the Secretary of the Interior has the authority to make minor boundary adjustments in NPS units which do not increase or decrease the gross acreage of a park unit by more than 23,000 acres. The land exchange involved under this alternative would have little or no effect upon the park's gross acreage.

VI. ALTERNATIVE MANAGEMENT OPTIONS - DUNKLE MINE STUDY AREA

Brief summaries of seven alternative management options for the Dunkle Mine Study Area are presented below. The alternatives are discussed in greater detail in the environmental impact statement.

Alternative 1 - Maintain Status Quo (Preferred Alternative)

This alternative would allow mining-related activities to continue on existing valid unpatented placer and lode claims.

Mineral development and mining activities would continue to be managed under existing NPS authorities and regulations, general and specific park stipulations, and normal permitting and approval requirements of other regulatory authorities. These activities, including adequate and feasible access, would continue to be subject to approval of mining plans of operations, with regard to protection of natural and cultural resources and other park values, and to a determination of claim validity. Pursuant to standard claim validation procedures, those unpatented claims deemed invalid would revert to public park status, and any mining operations and related activities associated with these claims would be terminated.

Claim acquisition would occur only on a willing seller - willing buyer or donation basis except in those cases where it could be determined that mining would significantly and adversely affect park lands. Acquisition of mining claims other than by donation would be subject to the appropriation of funds.

Alternative 2 - Maintain Status Quo

This alternative is the same as Alternative 1, and is repeated so that the alternatives are consistent in number for the two study areas, as is done in the Final Environmental Impact Statement.

Alternative 3 - Acquire All Mining Claims

All valid unpatented mining claims in the Dunkle Mine Study Area would be acquired by the federal government under this alternative. Unpatented claims would be subject to adjudication of validity prior to purchase.

Alternative 4 - Offer Term Operating Rights

As no significant mineral production has occurred on the present mining claims in the Dunkle Mine Study Area, this alternative does not apply.

Alternative 5 - Allow Additional Time for Perfecting Claims

Under this alternative all claimants holding unpatented placer and lode claims in the study area that are unperfected would be granted an additional 5 years to explore and achieve a valid mineral discovery within the meaning of the mining laws of the United States. An Act of Congress would be required before this alternative could be implemented.

If the claims are determined to be valid, mining operations could proceed, subject to NPS regulations. If the claims cannot be perfected and are determined to be invalid, the claims would revert to public park status.

Alternative 6 - Expand Mineral Development Possibilities

In this alternative, those portions of the Dunkle Mine Study Area with known or suspected significant mineral resources would be opened to mineral entry and location under the mining laws of the United States.

Those areas containing significant metalliferous minerals could be opened to mineral entry and claim location for 15 years under the Mining Law of 1872. All provisions of the Mining Law of 1872 would apply except any patent issued would convey title to the subsurface estate only. The surface estate of all lands open to mineral entry would remain in federal ownership and continue to be administered by the National Park Service. An Act of Congress would be necessary before this alternative could be implemented.

Entry, claim location, recordation and annual filing activities would be managed pursuant to existing BLM regulations (43 CFR 3800). All mining operations, activities and surface uses would be subject to NPS regulations (36 CFR 9A).

Prior valid rights would be protected, and existing and future mining operations and related activities could continue on existing valid unpatented mining claims in the Dunkle Mine Study Area.

This alternative would open approximately 9,421 acres of land in the Dunkle Mine Study Area to mineral entry and location. This acreage is the area of significant metalliferous mineralization that is not presently overlain with existing lode and placer claims. The total area open to mineral development, including the 3,020 acres of existing claims, would be 12,441 acres.

Alternative 7 - Remove Mineralized Areas From The Park

In this alternative, the existing park boundary in the Dunkle Mine Study Area would be adjusted to exclude significantly mineralized lands. A land exchange (for other areas of significant natural, cultural, or recreational values outside the park) would be a condition of removing these areas from the park.

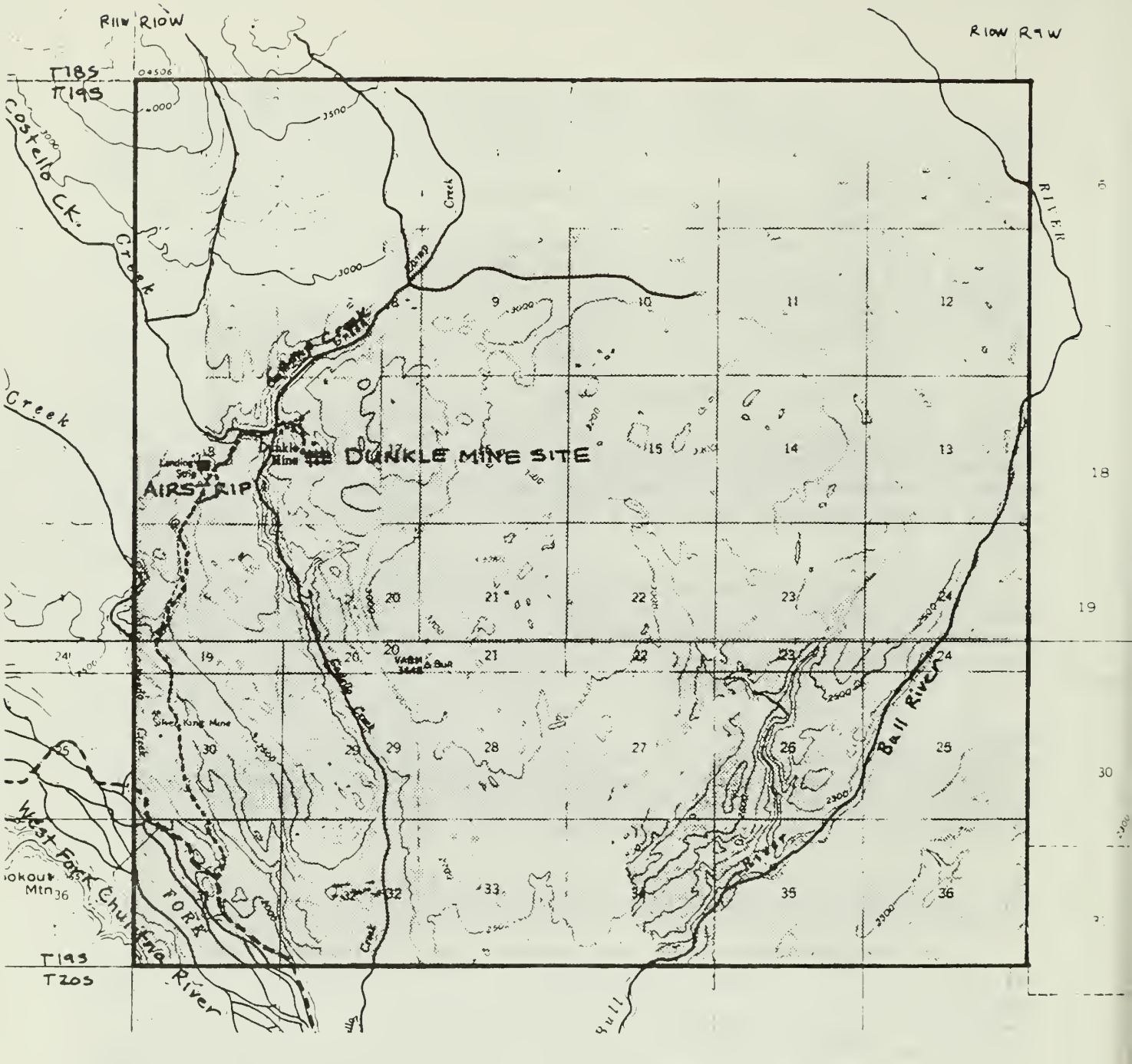
Specific land exchange possibilities would be subjected to further analysis and negotiations between the State of Alaska and the Department of Interior. Portions of the Dunkle Mine Study Area which could be considered for exchange involve approximately 18,681 acres. (See Figure 2).

An Act of Congress would not be required to implement this alternative because pursuant to Section 103(b) of ANILCA, the Secretary of the Interior has the authority to make minor boundary adjustments in NPS units which do not increase or decrease the gross acreage of a park unit by more that 23,000. The land exchange envisioned under this alternative would have little or no effect upon the gross acreage of the park.

VII. STUDY GROUP RECOMMENDATIONS AND SELECTED PREFERRED ALTERNATIVES

Public comment on the draft environmental impact statement tended to be strongly polarized. Generally, parties either preferred the alternative to acquire all mining claims or the alternative to remove mineralized areas from the park. Ninety-six written comments were received. The "acquisition" alternative was favored over the "removal" alternative by a 2 to 1 margin in the written comments. At a public hearing in Anchorage testimony was roughly split between these alternatives, while at hearings in Fairbanks, Healy and Kantishna, testimony strongly favored removal of the areas from the park. Comment at the public hearings is summarized in Appendix XVI.

Statements by the Alaska Departments of Environmental Conservation and Fish and Game on selection of the preferred alternatives for the two study areas are contained in Appendices XIV and XV respectively. A statement by the U.S. Fish & Wildlife Service is included as Appendix XIX, and a statement by the National Park Service is as Appendix XX.



DUNKLE MINE STUDY AREA BOUNDARY

AREA TO BE REMOVED FROM PARK

0 1 2 MILES

0 1 2 3 Kilometers

North

Alternative 7

REMOVE MINERAL RESOURCE AREAS FROM THE PARK

Dunkle Mine Study Area

Denali National Park and Preserve

United States Department of the Interior National Park Service

FIG. 2

10/10102A
DSC/Feb. 84

Kantishna Hills Study Area

Prior to the study group's selection of a preferred alternative for the Kantishna Hills Study Area, the positions of the seven representative agencies on the alternative management options were as follows:

Agency	Preference
National Park Service	"Maintain Status Quo"
U.S. Fish & Wildlife Service	"Acquire All Mining Claims", if impractical, then "Allow Additional Time for Perfecting Claims", then "Maintain Status Quo"
U.S. Bureau of Mines	Abstain
U.S. Geological Survey	Abstain
Alaska Dept. of Natural Resources	"Implement Mineral Leasing Program"
Alaska Dept. of Environmental Conservation	"Maintain Status Quo"
Alaska Dept. of Fish & Game	"Maintain Status Quo"

Following discussion, the study group reached the preferred alternative to "Implement Mineral Leasing Program". Many agency concerns were alleviated by the conditions written into the proposed mineral leasing program, which require that water quality standards and other standards would be attained prior to implementation of the program. This alternative is summarized below and described in greater detail in the Final Environmental Impact Statement.

The preferred alternative is a locatable mineral leasing program for a portion of the Kantisnna Hills Study Area (see Figure 1). The entire study area would remain within Denali National Park and Preserve with the National Park Service as land manager and administrator of the program.

The leasing system should not be implemented until such time as the regulatory framework surrounding placer mining has stabilized and the mining industry is attaining appropriate water quality standards for their wastewater discharge. The study group recommends that the program be implemented in federal fiscal year 1989. However, the program should not be implemented if placer miners on existing claims in Kantishna are not meeting water quality standards in the Moose Creek and Bear Paw River drainages and are not meeting stipulated reclamation requirements of the National Park Service.

The study group recommends that Congress instruct the Alaska Regional Director of the National Park Service to implement a locatable mineral leasing system for both placer and lode mineral deposits on unclaimed land in those portions of the Kantisnna Hills Study Area designated in Figure 1 during federal FY89 unless the Director finds that the then present technology for meeting water quality standards for placer mines is insufficient to attain those standards and adequately protect other resources, and that those water

quality standards are not being attained. The portions recommended for leasing include: for lode deposits - the Clearwater Fork drainage and those portions of the Moose Creek, Glacier Creek and Caribou Creek drainages depicted in Figure 1; for placer deposits - only those portions of the Moose Creek, Glacier Creek and Caribou Creek drainages depicted in Figure 1 (the Clearwater Fork drainage is to be excluded for leasing of placer deposits).

The study group is particularly concerned that placer mining operations on leases to be issued under this program meet reclamation and water quality standards. The Moose River, Glacier Creek, Caribou Creek and Bear Paw River are known to contain anadromous fish. In addition, the Toklat River, downstream from the Clearwater Fork which flows along the margin of the study area, is a highly valuable spawning area for the interior Alaska fall chum salmon run. The Clearwater Fork also has high values for moose, caribou, fish and recreation.

Recommended items to be considered in developing the leasing system are outlined below:

1) A reasonable time should be set during which a lessee must discover and develop a mineral deposit on his lease or the lease will expire.

2) The leasing system should provide for a reasonable annual rental to be paid to the U.S. Treasury.

3) The leasing system should provide for a reasonable royalty to the U.S. Treasury on production from mineral deposits; production royalties should be set against annual rentals.

4) Requests for construction of new land access routes to leaseholds should be carefully analysed to assure that reasonable access is guaranteed but that new access routes are kept to a minimum. Title XI of ANILCA will govern the provision of access, as appropriate.

5) Interagency review of the plan of operations submitted by the lessee should be provided for. An approved plan of operations would include all major authorizations required from state and federal regulatory agencies. Additional interagency review should occur only if the lessee submits a revised plan of operations at a later time.

6) Leases should contain stipulations addressing environmental concerns and provisions that a mining operation will be immediately suspended if a miner is violating established environmental guidelines.

7) Leases should contain specific reclamation or restoration standards to mitigate long-term impacts of mining operations.

8) No surface rights beyond those reasonably necessary for the exploration, development and production of mineral deposits should be granted with the lease.

9) The mineral leasing program should be developed by the National Park Service prior to 1989 with full public participation.

Existing mining claimants will retain their vested rights under the 1872 Mining Law; corners of existing claims should be permanently established with monuments cemented into the ground.

The study group recommends that "willing seller - willing buyer" acquisition of any inholdings in the study area be allowed as funds are available. The National Park Service would retain existing authorities to acquire title to surface rights on existing patented claims through condemnation if such is clearly in the public interest and funds are specifically appropriated by Congress for such.

The study group also recommends that efforts to bring existing placer mining operations into compliance with water quality standards should be increased in the years preceding 1989. Most of the existing mining operations in the Kantishna Hills Study Area have been exceeding water quality standards in their discharge of mining wastewater to levels which are greatly in excess of those attainable . A coordinated program of technological development, technical assistance and enforcement should be pursued by the appropriate regulatory authorities. Operation of mines which are not making good faith efforts to comply with water quality standards should be suspended. Existing operators in the Kantisnna Study Area should be notified of this policy well in advance of the mining season. Adequate funding, both for state and federal agencies, will be needed for this program, and the study group recommends that such funding be appropriated. Unless such a program is established with annual review, the group is concerned that sufficient progress towards attaining compliance with water quality standards will not be made, hence disallowing the leasing program to be implemented in federal fiscal year 89.

Finally, the study group recommends that a decision as to whether or not the Stampede Road should be built (providing a northern access route to Kantishna) should be postponed until such time as the need for the road manifests itself. In this recommendation the study group recognizes 1) that existing miners in the Kantishna Study Area are guaranteed reasonable access and 2) future access along any northern route would be governed by the Title XI process of ANILCA.

Dunkle Mine Study Area

Prior to the study group's selection of a preferred alternative for the Dunkle Mine Study Area, the positions of the seven representative agencies on the alternative management options were as follows:

Agency	Preference
National Park Service	"Maintain Status Quo"
U.S. Fish & Wildlife Service	"Acquire All Mining Claims", if impractical, then "Allow Additional Time for Perfecting Claims", then "Maintain Status Quo"
U.S. Bureau of Mines	Abstain

U.S. Geological Survey	Abstain
Alaska Dept. of Natural Resources	"Remove Mineralized Areas From The Park"
Alaska Dept. of Environmental Conservation	"Maintain Status Quo"
Alaska Dept. of Fish & Game	"Maintain Status Quo"

The study group reached a consensus for the Dunkle Mine Study Area on the alternative to "Maintain Status Quo". However, this consensus was reached with the caveat that the study group felt that available data on both the mineral resources of the study area and the use by the Denali Caribou herd of the area were only marginally sufficient to make the decisions required by ANILCA. The study group would have preferred additional data on the mineralized areas in the Dunkle Mine Study Area and data on the likely long-range effects of possible mineral development in the Dunkle township on the caribou herd.

Drilling of mineral deposits on unpatented claims in the Dunkle Mine Study Area by the study's contractor was prohibited by Sec. 1010 of ANILCA. Hence mineral data included only geological and geophysical data and surface sampling. The level of use by the Denali caribou herd appears to vary from year to year, and a longer term study of that use would have been desirable.

The study group's preferred alternative is to "Maintain Status Quo". Selection of this alternative is based primarily on concerns for the Denali Caribou Herd which uses portions of the Dunkle Mine Study Area for calving or post calving in most years. The herd is a major attraction of the national park; as such it is undoubtedly the most observed caribou herd in Alaska. The herd is currently at a very low level (approximately 1000 animals). At such a fragile level, it is feared that future mining activities could adversely affect the herd.

APPENDIX I

Listing of reports completed for the Kantishna Hills/Dunkle Mine Study

B I B L I O G R A P H Y

Alaska Department of Natural Resources, Division of Gelogical and Geographical Survey, 1983. Mineral Resource Modeling, Kantishna--Dunkle Mine Study Areas, Alaska.

Alaska Department of Natural Resources, Division of Geological and Geophysical Survey, 1983. Probabilistic Regional Mineral Assessment Study.

Department of the Interior, National Park Service. Environmental Impact Statement-Kantishna Hills/Dunkle Mine Study, Alaska.

DOWL/PLAN Graphics, 1983. Claim Acquisition Cost Study.

Kertell, Kenneth. Wildlife and the Effects of Mining in the Kantishna Hills, Denali National Park and Preserve, Research/Resource Management Report AR-2. U.S. Department of the Interior, National Park Service, 1984.

Meyer, Scott C., Biological Technician and Kavanagh, Ross C., Project Administration. Fish Resources and the Effects of Mining Activities in the Kantishna Hills, Denali National Park, 1982 and 1983 Reports. U.S. Department of the Interior, National Park Service, Alaska Regional Office.

Salisbury and Dietz, Inc. 1983 Mineral Resource Studies in Kantishna Hills and Dunkle Mine Areas, Denali National Park and Preserve.

Sexton, Shawn E., Environmental Engineer. Kantishna Hills Heavy Metalic Investigation, 1982. U.S. Fish & Wildlife Service, Northern Alaska Ecological Services.

Sexton, Shawn E, Environmental Engineer. Report of the Alaska Department of Environmental Conservation's Participation in the 1982 Kantishna Hills Study.

U.S. Bureau of Mines, 1983. Kantishna Feasibility Studies.

U.S. Department of the Interior, National Park Service. Caribou Use of the Cantwell Calving Grounds, Denali National Park and Preserve, Alaska, Research/Resource Management Report AR-1.

U.S. Department of the Interior, National Park Service, 1982. Preliminary Research Summary, Cultural Resource Investigations in the Dunkle Mine and Kantishna Hills Study Areas, Alaska.

U.S. Department of the Interior, National Park Service, December 1982. Recreational Potential, Kantishna Hills/Dunkle Mine Study Areas, Denali National Park and Preserve, Alaska.

U.S. Department of the Interior, National Park Service, December 1982. Wilderness Potential, Kantishna Hills/Dunkle Mine Study Areas, Denali National Park and Preserve, Alaska.

West, Robin L. Kantishna Hills Heavy Metals Investigation. U.S. Fish and Wildlife Service, Northern Alaska Ecological Service, 1982.

APPENDIX II

Mineral Resource Modeling, Kantishna-Dunkle Mine Study Areas, Alaska

EXECUTIVE SUMMARY

MINERAL-RESOURCE MODELING, KANTISHNA-DUNKLE MINE-STUDY AREAS, ALASKA

By
T.K. Bundtzen

EXECUTVE SUMMARY

The Kantishna and Dunkle mine-study areas (fig. 1) have sustained mining activity since the early part of the 20th century. Total mineral production is 265,000 oz of silver, 67,000 oz of gold, 5 million lb of antimony, 64,000 tons of coal, and several million lb of lead and zinc worth $38.37 million at March 1983 national-commodity price levels. With the exception of coal, all mineral production was derived from the Kantishna mining district.

This report summarizes mineral-resource modeling in the Kantishna-Dunkle mine-study areas of Denali National Park Preserve. These results are preliminary and subject to modification pending results of mineral exploration during the summer of 1983. Studies of specific economic viability, claim validity, profitability, employment levels, or economic-multiplier effects have not been attempted.

In this study, a hypothetical resource base for both mineralized areas was established using all available information, including channel and bulk samples, mine maps, and drilling, geological, land geophysical data acquired during past investigations. Half-square modeling techniques were applied to

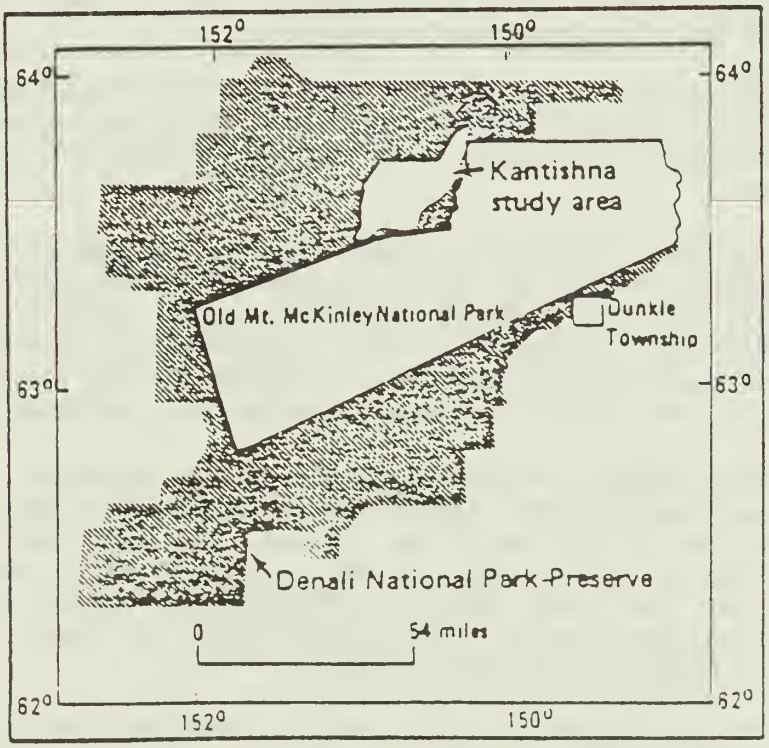


Figure 1. Location of Kantishna and Dunkle study areas, Denali National Park Preserve.

well-known mineralized vein systems in the Kantishna mining district, and the veins were also compared to similar mineral belts in Canada, Idaho, and Montana. Stratiform, metasomatic, and low-grade stockwork base-metal deposits in the Kantishna and Dunkle areas were compared to similar deposits in the southwestern United States. Placer-gold deposits in the Kantishna mining district were evaluated in terms of present activity and speculative reserves and resources. Coal reserves and resources were determined from private exploratory efforts. The resource figures generated from the modeling efforts were then applied to hypothetical low, medium, and high mineral development scenarios to estimate economic and environmental impacts.

The Kantishna portion of the study area contains an elongate 40-mi-long, northeast-trending mineral belt known for silver and gold enriched polysulfide crosscutting veins, placer-gold deposits, and antimony and base-metal lodes. Four concentrations of veins, Quigley Ridge, Banjo Mine, Spruce-Glenn Creek, and Slate and Last Chance Creeks and Stampede, were separately evaluated. Twenty-three silver enriched vein-fault systems concentrated in a 15 mi^2 area near Quigly Ridge contain a half-square resource estimate of 412,892 tons of ore with an average grade of 39.76 oz per ton silver, 0.14 oz per ton gold, 6.4 percent lead, and 2.3 percent zinc. Geologic criteria of the study area were compared with those of lodes of the Coeur d'Alene and Keno Hill districts of Idaho and Yukon Territory, respectively. The Kantishna veins can best be compared to the Keno Hill deposits. Detailed structural, geologic, grade, and reserve-data comparisons indicate that the Kantishna silver lodes may contain up to 1.16 million tons of ore of similar grade to that calculated with the half-square estimate.

Primary gold lodes in the Banjo Mine area contain a half-square resource of 173,960 tons of ore grading 0.39 oz per ton gold, 3.59 oz per ton silver, and 1.2 percent combined lead and zinc. A smaller portion of this resurce tonnage contains tungsten.

Six deposits in the Spruce-Glenn Creek area are estimated to contain 83,929 tons of mineralization with an average grade of 0.07 oz per ton gold, 8.05 oz per ton silver, and 2.5 percent combined lead, zinc, and antimony. The half-square resource estimate is not economically viable under present metal-commodity price levels, but the data base is very scant, and additional detailed sampling and exploration are necessary in this mineralized area.

Lodes on the Slate and Last Chance Creeks and at Stampede account for over half the antimony production in Alaska and a large percentage of United States domestic production during World War II and the Korean War. A half-square resource estimate of 560,720 tons of ore grading 11.93 percent antimony (with credits of silver and gold) amounts to almost 25 percent of the published United States antimony reserve base; 12,000 tons of high- and low-grade ore have been identified in three main deposits.

The summation of the half-square resource estimates for the Kantishna veins is 1.23 milion tons with an "in-place" worth of $427 million in March 1983 metal-commodity prices (app. B). Silver accounts for 49 percent of the value, followed by antimony (32 percent), gold (13 percnt), and lead, zinc, and Tungsten (6 percent). Hypothetical mine-modeling scenarios indicate that

annual production of antimony and silver would be nationally significant while lead, zinc, gold, and tungsten would not.

Known skarn and stratiform mineral deposits in the Kantishna mining district are thought to be subeconomic, but detailed bulk sampling of these and other occurrences is recommended. Some mineralized tuffs in the Spruce Creek Sequence bear similarities to auriferous systems described in the Red Lake District in Canada.

Placer gold is one of the most important mineral commodities extracted from the Kantishna mining district and accounts for 75 percent of the total dollar value. At least 14 streams have been mined, and more than 12 small- and medium-sized mechanized operations were active last year. Speculative reservations and resources of auriferous gravel amount to 4.52 and 16.78 million yd^3, respectively. Estimates of grade and tenor of pay streaks cannot be made with existing data. The present 3,500-4,000 oz-per-yr gold production will probably be sustained in the foreseeable future.

The Dunkle Mine township is part of the Chuitna-Yentna mining district, a major epigenetic base and precious metal province in the southern Alaska Range. Detailed surface and subsurface investigations of the area by government agencies are incorporated in this study. A voluminous collection of private subsurface, geophysical, geochemical, and geological data is the primary source of information for the NIM claim block.

Although there has been no metal production from the area, the nearby Golden Zone Mine is currently under development and has produced gold, copper, and silver. Most mineral deposits are confined to three main areas near Bull River, and all are of the epigenetic-vein, vein-disseminate, and breccia-pipe types. Metals include major copper, arsenic, gold, and silver and minor tin, molybdenum, lead, zinc, and bismuth.

Past data collections show very hypothetical resources of 20,000 tons of relatively high-grade gold and silver vein deposits, 3.23 milion tons of gold- and silver-bearing breccia-pipe mineralization, and as much as 100 million tons of low-grade, stockwork-style copper and silver $\pm$ gold mineralization. Specific grade computations cannot be made with existing data, and promising target areas need much more exploratory work.

Placer deposits in Colorado Creek are gold-bearing outwash gravels. Intermittent production and development has occurred since 1959, but the potential of the deposits is unknown.

The W.E. Dunkle or Costello Creek Mine in the Dunkle Mine township produced 64,000 tons of lignitic to subbituminous coal from underground-mining operations during 1940-54. Approximately 350,000 tons of bituminous coal remain in the drilled reserve base; up to an 8-million-ton coal resource is estimated in the upper Costello-Colorado-Damp Creeks basin. Small-scale extraction has been studied for many years. Private feasibility studies completed in the 1960's indicate a positive rate of investment return from small open-cut mine developments both in and out of the township. Coal preparation may require the removal of moisture and the addition of an oil base to prevent spontaneous combustion.

APPENDIX III

1983 Mineral Resource Studies in the Kantishna Hills and Dunkle Mine Areas, Denali National Park and Preserve

EXECUTIVE SUMMARY

1983 Mineral Resource Studies

Kantishna Hills and Dunkle Mine Areas

Denali National Park and Preserve

EXECUTIVE SUMMARY

Prepared by

SALISBURY & DIETZ, INC.

December 16, 1983

TABLE OF CONTENTS

ILLUSTRATIONS

INTRODUCTION

The Alaska National Interest Lands Conservation Act (ANILCA) was passed by Congress on December 2, 1980. Section 202(3)(b) of this act mandated the Alaska Land Use Council (ALUC) to conduct studies of the Kantishna Hills and Dunkle Mine areas (figure 1), in the newly established Denali National Park and Preserve. In addition to other resource studies, the ALUC was directed to (1) evaluate mineral resources, (2) compile information related to mineral potential, (3) estimate the cost of acquiring mineral properties, and (4) assess the consequences of further mineral development.

On May 24th, 1983, U.S. Bureau of Mines Contract No. S0134031 was awarded to Salisbury & Dietz, Inc. to evaluate mineral resources and compile information related to the mineral potential of the two study areas. Professional personnel were provided by Salisbury & Dietz, Inc., and by subcontractors C. C. Hawley and Associates, Inc. and WGM, Inc. Key personnel on the project had in excess of 110 man years experience in mineral resource assessment, including more than 80 years in Alaska. A summary of previous mineral resource information pertaining to the study areas was compiled and presented to the U.S. Bureau of Mines in a preliminary report in early June. Field work began on the project on June 6th and was completed by September 14th. During that period approximately 11,000 man hours were expended by 24 professional personnel working on the project. Work was concentrated in areas of known mineralization and on existing claims, but reconnaissance surveys were conducted throughout both study areas.

In the Kantishna Hills study area 67 square miles were geologically mapped and more than 2,000 samples were collected for geochemical analysis. Over 100 individual deposits and mineral occurrences were mapped and sampled. Because of restrictions imposed by ANILCA core drilling was limited to patented claims and aggregated 4,909 feet in 22 holes. Over 400 core samples were assayed for metal content and detailed drill logs were prepared for each of the holes. Placer deposits were evaluated by various means at 202 sites and 227 placer samples were analyzed for gold and associated by-products. Operations at 14 active placer mines were closely monitored and the remaining six observed periodically, so that results from actual mining could be assessed. Approximately 200,000 line feet of geophysical surveys were conducted, primarily in the Kantishna area. Survey grids, drill holes, sample sites, and mineral occurrences were surveyed by modern methods at 380 locations. Analytical data were treated statistically utilizing computer assisted methods and compiled on computer tapes for future use.

Field work in the Dunkle Mine study area consisted of geologic mapping, geochemical sampling, and evaluation of pre-existing data. Nine known prospects were mapped in detail and sampled. The entire study area, except where completely covered by overburden, was examined on a reconnaissance basis. More than 275 stream sediment, panned concentrate, rock chip, and soil samples were collected for analysis. Placer potential was evaluated in several gold-bearing drainages and samples were taken at nine locatons. Several line miles of magnetometer surveys were completed to augment previous

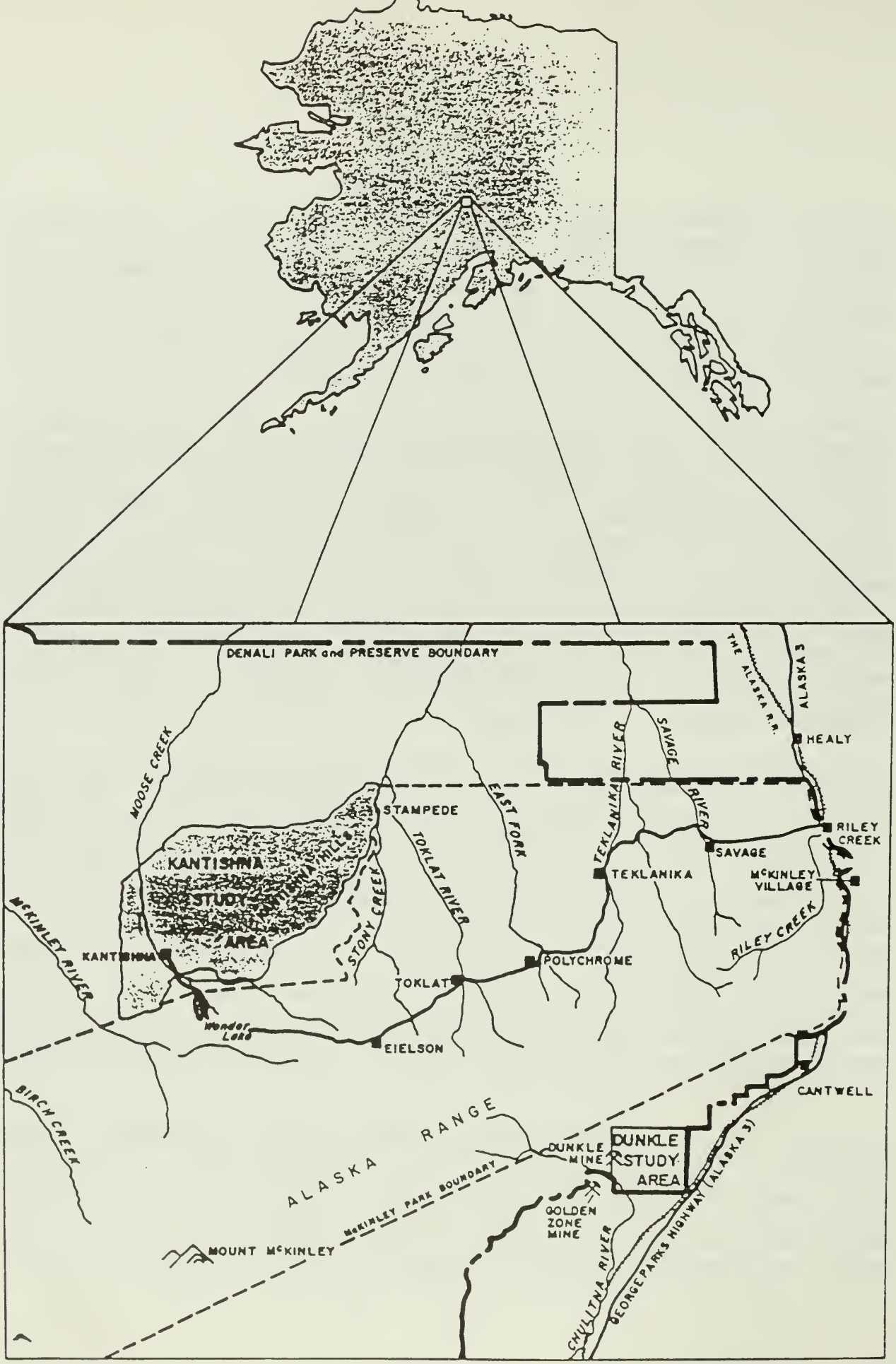


Figure 1 - Index Map

coverage. Survey stations were established at 27 points to tie in sample grids and other pertinent features. Core drilling could not be done because there are no patented claims in the area.

The final report will consist of detailed results of the 1983 project and a summary of previous data. The report and appendix material will total several hundred pages and will be accompanied by approximately 20 large maps, numerous figures and tables, and a complete bibliography. A preliminary draft of the report was delivered to the U.S. Bureau of Mines on November 4th and a final printed version should be available by the end of January.

KANTISHNA HILLS STUDY AREA

Mines in the Kantishna Hills study area have produced more than 85,000 ounces of gold, 265,000 ounces of silver, 504,000 pounds of lead, 5,000,000 pounds of antimony, and an undetermined amount of zinc. More than 90% of the gold was produced by small to medium scale placer operations. This area is the source of most of the antimony production in Alaska and ranks as the second largest antimony producer in the United States. Gold, silver, lead, and zinc have been mined from several relatively small vein-type lode deposits primarily in the vicinity of Quigley Ridge (figure 2). Studies during the 1983 season indicate the presence of geologic environments which could contain base and precious metal massive sulfide deposits of major magnitude. These environments are not covered by existing claims and because of restrictions imposed by ANILCA could not be tested by drilling.

Up to 20 small to medium size (5 cy/day to 1500 cy/day) placer operations employing a total of about 125 people were active in the Kantishna area during the 1983 season. Significant reserves of gold-brearing gravel remain unmined both on and off existing claims.

Characteristically the precious-base metal veins are limited in tonnage but high in metal value. Several of the known deposits could probably support small scale mining. Seventeen new gold and silver occurrences were found during the study and there is a high probability that similar deposits remain undiscovered.

Known antimony mines and prospects contain modest proven reserves. Five previously undiscovered antimony occurrences were found during the 1983 study. It is probable that additional reserves could be discovered or developed as extensions of known deposits. Antimony production from the district could continue to be significant in terms of U.S. production but probably not in terms of U.S. consumption or free-world supply.

Geologic environments favorale for deposition of massive sulfide deposits are indicated by surface mapping, geochemical sampling, and geophysical surveys. Eight previously unknown massive sulfide occurrences were found within these environments. Several zones of iron precipitates are drained by streams which are highly acidic and anomalous in color. Except for surface data, these environments remain unevaluated. Deposits hosted by similar environments contain high grade reserves measured in millions of tons.

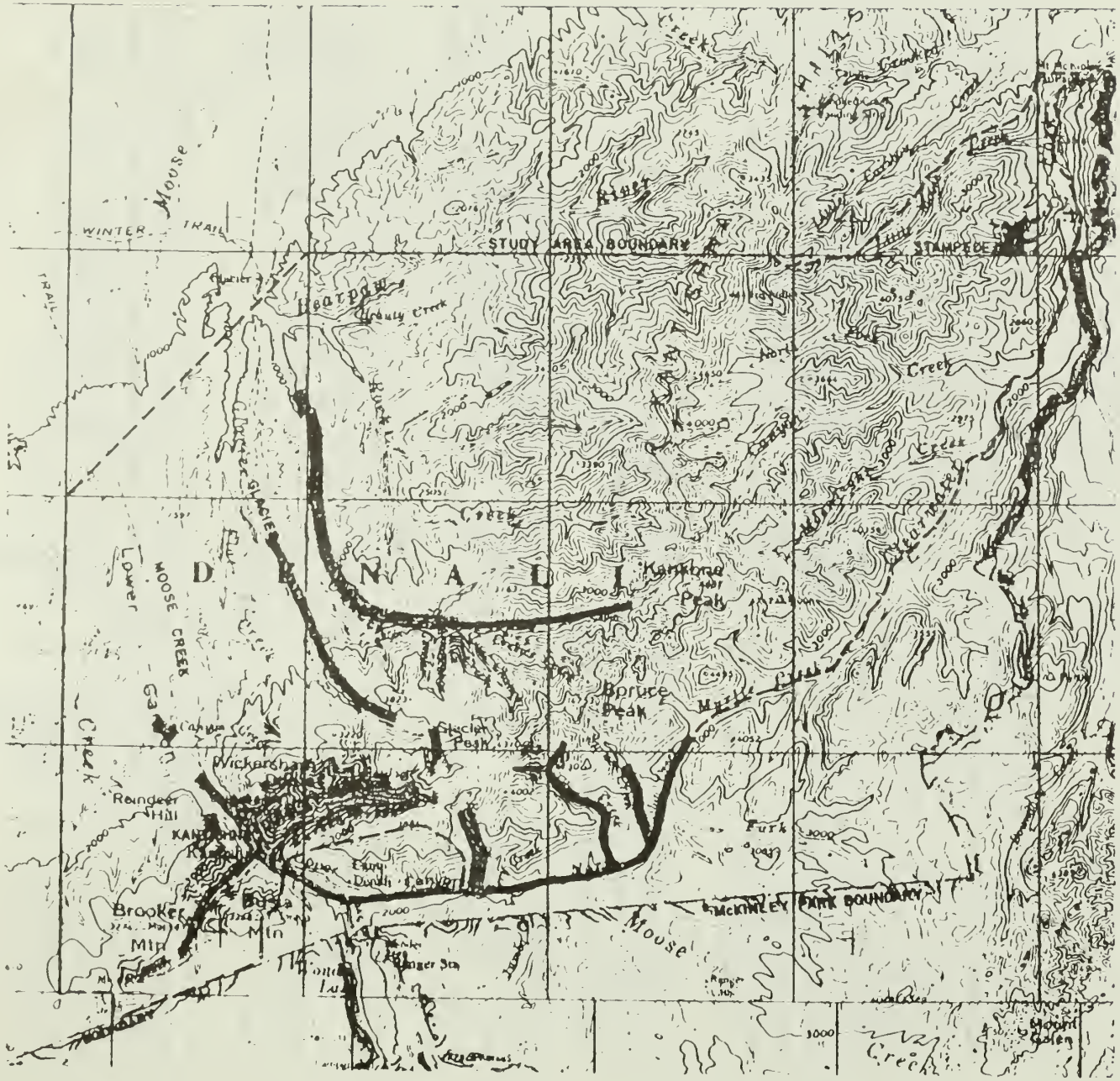


Figure K-2-Mining Claim Location Map-Kantishna Hills Study Area

Placer Deposits

The Kantishna Hills area is one of about 37 producing gold placer districts in Alaska. Production in recent years has increased from 800 ounces in 1974 to an estimated 7,500 ounces in 1983. For comparison, total United States lode and placer gold production in 1982 was 1,400,000 ounces of which 174,900 ounces were produced in Alaska.

Placer gold is a natural alloy or mixture of gold, silver, and other metals. Fineness of the placer gold is the ratio of gold to other metals expressed in parts per thousand. The average fineness of placer gold samples obtained during the study was 750. Sampling of operations active during 1983 indicates that recovered placer gold grades ranged from 0.005 to 0.062 oz/cy and averaged 0.022 oz/cy. Gold content adjusted for fineness ranges from 0.004 to 0.045 oz/cy and averages 0.016 oz/cy.

It is estimated that the district contains 43 million cubic yards of minable stream and terrace gravels containing 688,000 ounces of gold (figure3). Of this total, 18 million cubic yards are covered by existing claims and contain an estimated 288,000 ounces of gold. Fine placer gold from the Kantishna District is sold for contained gold value after adjustment for fineness. Coarser placer gold is marketed to jewelers at prices ranging from one to two times the spot price of gold. The price received for placer gold from operations monitored in 1983 averaged 0.83 times the spot price of gold. At $400/oz the in-ground value of unmined placer gold within the district is estimated at $314 million of which $131 million (or less than one-half) would be derived from gravels covered by existing claims.

Another 21 million cubic yards of terrace gravels contain anomalous amounts of gold. More than 200 million cubic yards of terrace and alluvial fan gravels are presently unevaluated but could contain significant reserves amenable to large scale mining.

Improvements in processing systems have increased recovery of fine gold, expanded mining capacities and enhanced plant portability. About 500,000 cubic yards were processed during 1983. Operating at maximum capacity, current operations could process approximately 800,000 cubic yards of gravel per year. At this production rate 20 to 50 years would be required to mine the indicated reserves on existing claims. Mining of potential reserves in the terrace and floodplain gravels could significantly increase production from the district but would probably be mined at a much higher rate impacting more on annual production than on mine life.

Lode Precious Metal Deposits

Precious metal production from lodes in the Kantishna region has been from several small but very rich vein deposits on Quigley Ridge, and from the Banjo Mine east of the ridge.

The Banjo Mine (figure 4), developed primarily for its gold content, was the largest precious metal mine in the region. It produced 13,693 tons of ore averaging 0.50 oz Au/ton and 0.52 oz Ag/ton.

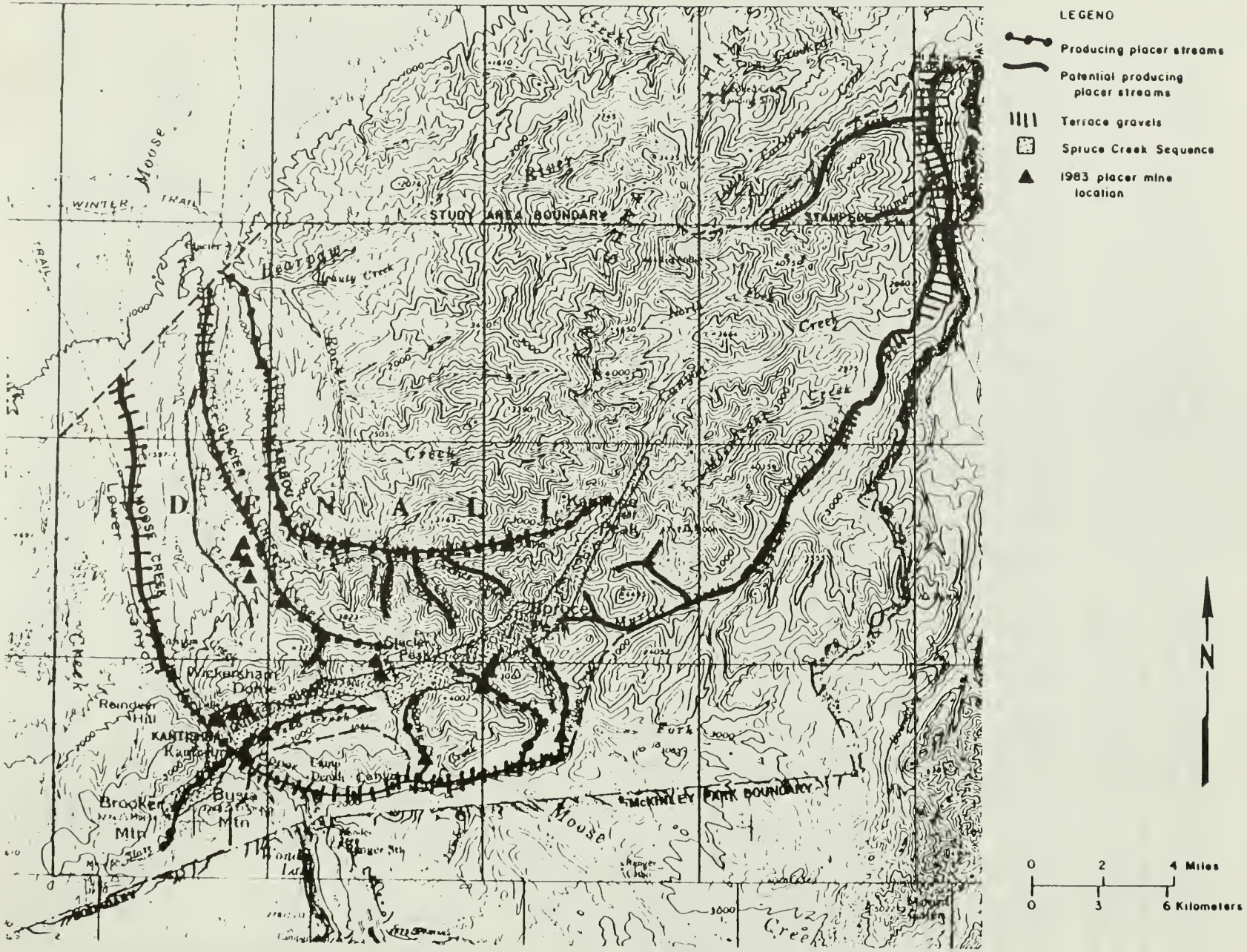
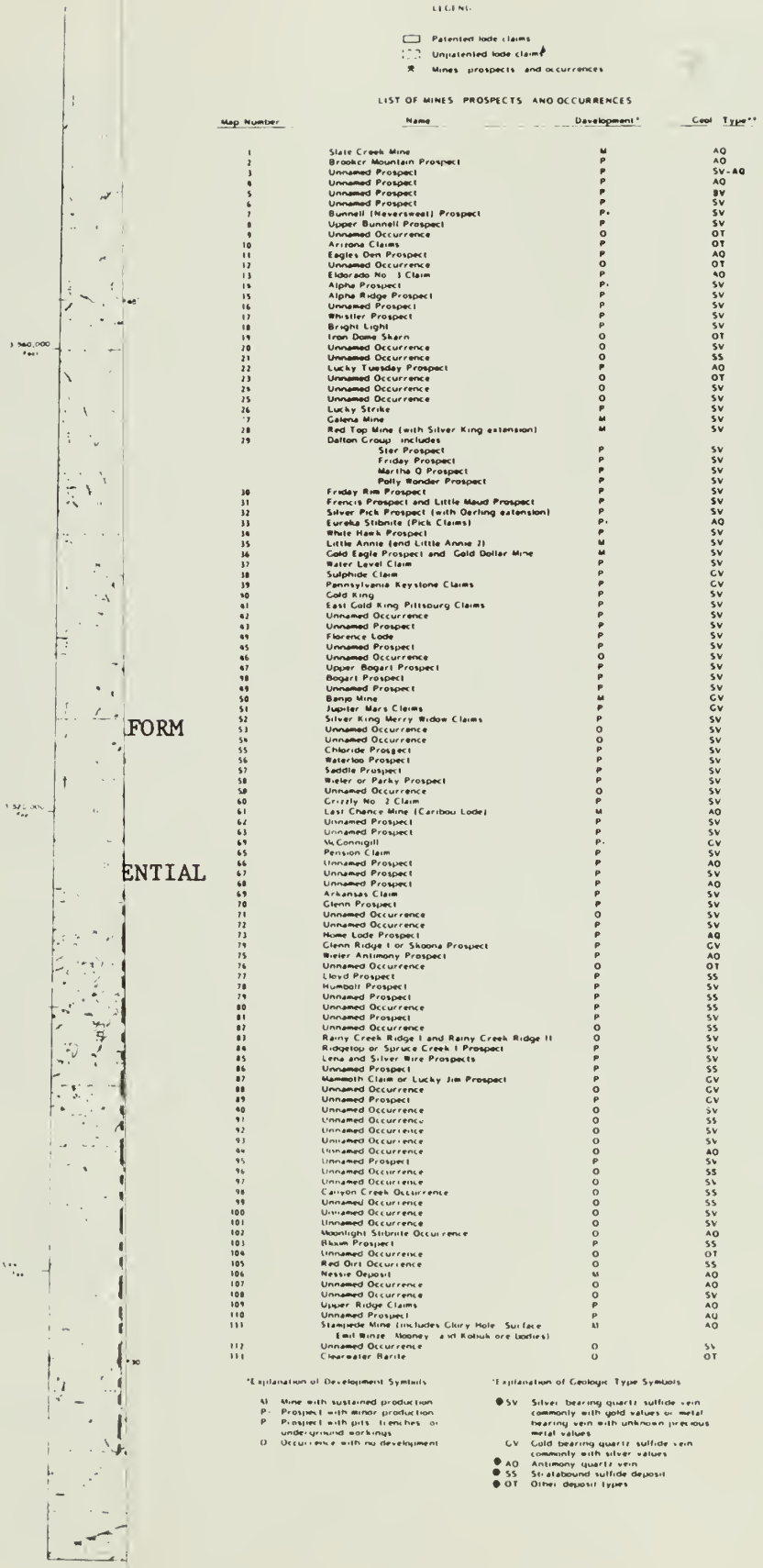


Figure 3 - Known and Potential Placer Gold Resources - Kantishna Hills Study Area



LEGEND

- Patented lode claims
- Unpatented lode claims
- Mines prospects and occurrences

LIST OF MINES PROSPECTS AND OCCURRENCES

Map Number	Name	Development*	Geol Type**
1	Slate Creek Mine	M	AQ
2	Brooker Mountain Prospect	P	AQ
3	Unnamed Prospect	P	SV-AQ
4	Unnamed Prospect	P	AQ
5	Unnamed Prospect	P	SV
6	Unnamed Prospect	P	SV
7	Bunnell (Neversweat) Prospect	P-	SV
8	Upper Bunnell Prospect	P	SV
9	Unnamed Occurrence	O	OT
10	Arizona Claims	P	OT
11	Eagles Den Prospect	P	AQ
12	Unnamed Occurrence	O	OT
13	Eldorado No 3 Claim	P	AQ
14	Alpha Prospect	P-	SV
15	Alpha Ridge Prospect	P	SV
16	Unnamed Prospect	P	SV
17	Whistler Prospect	P	SV
18	Bright Light	P	SV
19	Iron Dome Skarn	O	OT
20	Unnamed Occurrence	O	SV
21	Unnamed Occurrence	O	SS
22	Lucky Tuesday Prospect	P	AQ
23	Unnamed Occurrence	O	OT
24	Unnamed Occurrence	O	SV
25	Unnamed Occurrence	O	SV
26	Lucky Strike	P	SV
27	Galena Mine	M	SV
28	Red Top Mine (with Silver King extension)	M	SV
29	Dalton Group includes		
	Star Prospect	P	SV
	Friday Prospect	P	SV
	Martha Q Prospect	P	SV
	Polly Wonder Prospect	P	SV
30	Friday Rim Prospect	P	SV
31	Francis Prospect and Little Maud Prospect	P	SV
32	Silver Pick Prospect (with Oerling extension)	P	SV
33	Eureka Stibnite (Pick Claims)	P-	AQ
34	White Hawk Prospect	P	SV
35	Little Annie (and Little Annie 2)	M	SV
36	Gold Eagle Prospect and Gold Dollar Mine	M	SV
37	Water Level Claim	P	SV
38	Sulphide Claim	P	CV
39	Pennsylvania Keystone Claims	P	CV
40	Gold King	P	SV
41	East Gold King Pittsburg Claims	P	SV
42	Unnamed Occurrence	P	SV
43	Unnamed Prospect	P	SV
44	Florence Lode	P	SV
45	Unnamed Prospect	P	SV
46	Unnamed Occurrence	O	SV
47	Upper Bogart Prospect	P	SV
48	Bogart Prospect	P	SV
49	Unnamed Prospect	P	SV
50	Banjo Mine	M	CV
51	Jupiter Mars Claims	P	CV
52	Silver King Merry Widow Claims	P	SV
53	Unnamed Occurrence	O	SV
54	Unnamed Occurrence	O	SV
55	Chloride Prospect	P	SV
56	Waterloo Prospect	P	SV
57	Saddle Prospect	P	SV
58	Weiler or Parky Prospect	P	SV
59	Unnamed Occurrence	O	SV
60	Grizzly No 2 Claim	P	SV
61	Last Chance Mine (Caribou Lode)	M	AQ
62	Unnamed Prospect	P	SV
63	Unnamed Prospect	P	SV
64	McConnigill	P-	CV
65	Pension Claim	P	SV
66	Unnamed Prospect	P	AQ
67	Unnamed Prospect	P	SV
68	Unnamed Prospect	P	AQ
69	Arkansas Claim	P	SV
70	Glenn Prospect	P	SV
71	Unnamed Occurrence	O	SV
72	Unnamed Occurrence	P	SV
73	Home Lode Prospect	P	AQ
74	Glenn Ridge I or Skoona Prospect	P	CV
75	Weiler Antimony Prospect	P	AQ
76	Unnamed Occurrence	O	OT
77	Lloyd Prospect	P	SS
78	Humbolt Prospect	P	SV
79	Unnamed Prospect	P	SS
80	Unnamed Occurrence	P	SS
81	Unnamed Prospect	P	SV
82	Unnamed Occurrence	O	SS
83	Rainy Creek Ridge I and Rainy Creek Ridge II	O	SV
84	Ridgetop or Spruce Creek I Prospect	P	SV
85	Lena and Silver Wire Prospects	P	SV
86	Unnamed Prospect	P	SS
87	Mammoth Claim or Lucky Jim Prospect	P	CV
88	Unnamed Occurrence	O	CV
89	Unnamed Prospect	P	CV
90	Unnamed Occurrence	O	SV
91	Unnamed Occurrence	O	SS
92	Unnamed Occurrence	O	SV
93	Unnamed Occurrence	O	SV
94	Unnamed Occurrence	O	AQ
95	Unnamed Prospect	P	SV
96	Unnamed Occurrence	O	SS
97	Unnamed Occurrence	O	SV
98	Canyon Creek Occurrence	O	SS
99	Unnamed Occurrence	O	SS
100	Unnamed Occurrence	O	SV
101	Unnamed Occurrence	O	SV
102	Moonlight Stibnite Occurrence	O	AQ
103	Bloom Prospect	P	SS
104	Unnamed Occurrence	O	OT
105	Red Dirt Occurrence	O	SS
106	Nessie Deposit	M	AQ
107	Unnamed Occurrence	O	AQ
108	Unnamed Occurrence	O	SV
109	Upper Ridge Claims	P	AQ
110	Unnamed Prospect	P	AQ
111	Stemwede Mine (includes Glory Hole Surface Emil Winze Mooney and Rohuh ore bodies)	M	AQ
112	Unnamed Occurrence	O	SV
113	Clearwater Barite	O	OT

*Explanation of Development Symbols

- M Mine with sustained production
- P- Prospect with minor production
- P Prospect with pits trenches or underground workings
- O Occurrence with no development

**Explanation of Geologic Type Symbols

- SV Silver bearing quartz sulfide vein commonly with gold values or metal bearing vein with unknown precious metal values
- CV Gold bearing quartz sulfide vein commonly with silver values
- AQ Antimony quartz vein
- SS Stratabound sulfide deposit
- OT Other deposit types

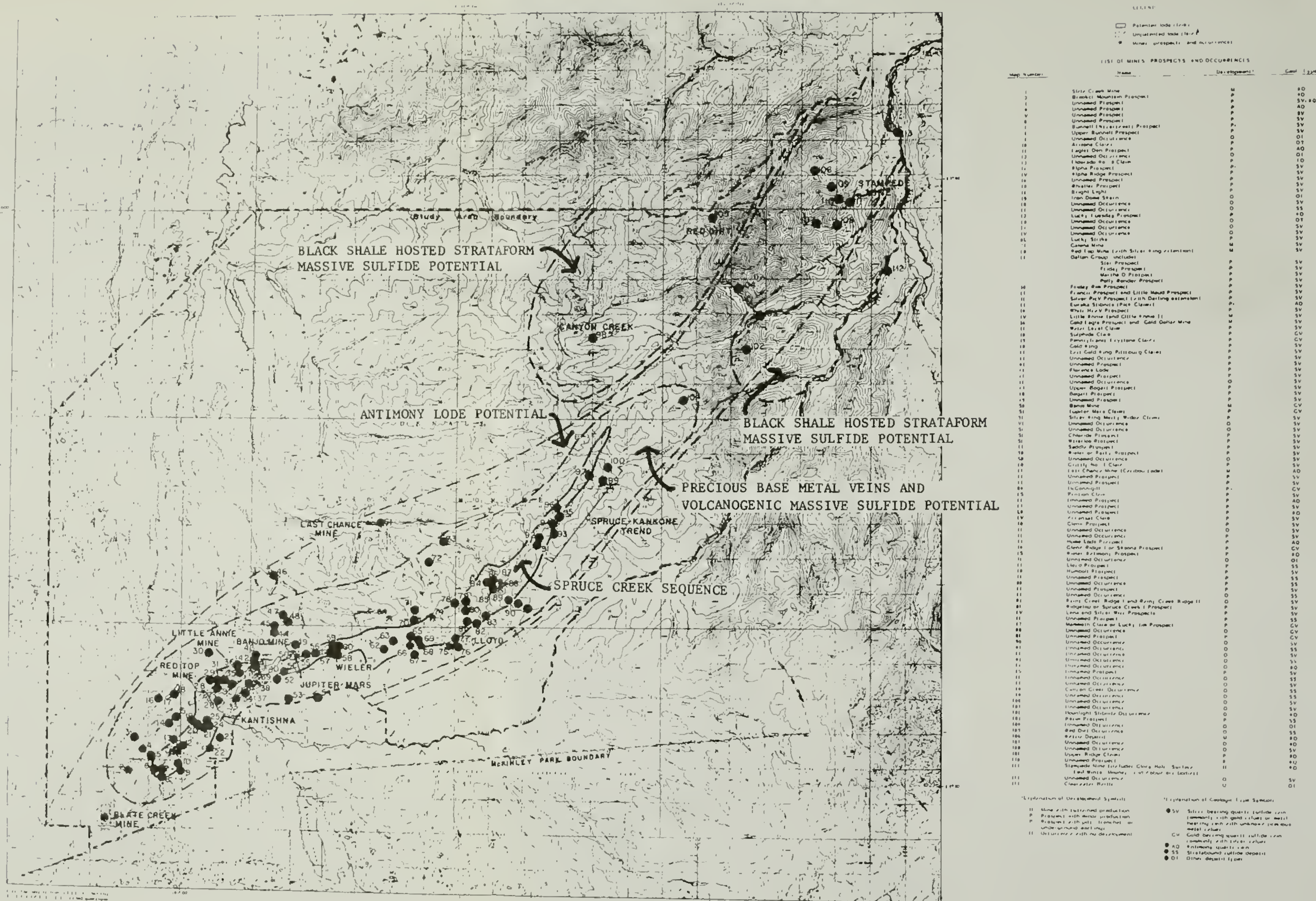
FORM

ENTIAL

KANTISHNA HILLS STUDY AREA

ROSPECTS, OCCURRENCES, AND LODE MINING CLAIMS

Figure K-4



KANTISHNA HILLS STUDY AREA
MINES, PROSPECTS, OCCURRENCES, AND LODE MINING CLAIMS

Figure K-4

Eight smaller but higher-grade deposits on Quigley Ridge were mined primarily for their silver content. Together, they produced 1,655 tons of ore containing about 258,000 ounces of silver, 450 ounces of gold, and more than 500,000 pounds of lead. The largest, the Little Annie Mine (figure 4), produced 715 tons with an average silver content of 162 oz/ton and an average gold content of about 0.1 oz/ton. The Red Top Mine (figure 4), another important deposit, produced 184 tons containing 237 oz Ag/ton and 1.0 oz Au/ton.

Mining of these deposits was confined to high grade lenses. Substantial tonnages of lower-grade material probably remains in the Red Top, Little Annie, and several other Quigley Ridge deposits.

During 1983 the only precious metal lode production came from the Wieler Prospect (figure 4) near the Banjo Mine. An estimated 156 tons of ore reportedly averaging 2.8 oz Au/ton and 65.3 oz Ag/ton were mined from this deposit and trucked to Fairbanks for milling.

The Spruce Creek Sequence (figure 4) assemblage of rocks hosts the majority of the precious metal vein deposits, and extends both northeast and southwest of Quigley Ridge (figure 4). A total of 76 precious metal vein occurrences were identified, either within the Spruce Creek Sequence of near the Spruce Creek-Birch Creek contacts. This entire trend is favorable for the occurrences of precious metal vein deposits. Significant new discoveries were found during the course of the 1983 study and it is likely that additional discoveries could be found, both on and off existing claims. A greater chance for precious metal lode production is likely if the study area is opened to mineral entry.

Three types of mining scenarios are indicated: (1) one or more deposits could be developed on a small scale similar to historic production; (2) prior data, confirmed by 1983 drilling, indicates that deposits such as the Red Top Mine could sustain operations in the 100 ton-per-day class; and (3) the metafelsite unit of the Spruce Creek Sequence could host bulk tonnage, low grade occurrences of precious metals similar to new discoveries in the lower 48 states.

Antimony Vein Deposits

Antimony-bearing vein deposits are scattered throughout the southern and eastern parts of the study area. Several of the deposits have been mined primarily during periods of war time demand. In general, production has been restricted to deposits consisting of high grade antimony ore. Attempts to beneficiate lower grade ore at the Stampede Mine were only marginally successful.

The Stampede Mine (figure 4), historically the largest producer in the district, produced 3,700,000 pounds of antimony ranking second in size among domestic antimony mines. The Slate Creek Mine (figure 4) has produced 800,000 pounds of antimony incuding 24,000 pounds shipped in 1983. The Last Chance Mine (figure 4) on Caribou Creek, site of the first lode production from the region in 1905, has produced a total of about 74,000 pounds of antimony. About 50,000 pounds of antimony were mined from a deposit on Eureka Creek in 1915.

Based on drill and underground sampling information, the Stampede Mine contains a known reserve of 6,280 tons of antimony ore. Three other deposits in the region have developed reserves totaling 5,650 tons. Additional reserves probably exist along geologically favorable but as yet untested extensions of the known deposits. Total potential resource estimates range from 40,000 to 560,000 tons of ore grading approximately 12% antimony.

Given favorable demand, it is likely the region could reach an annual production rate on the order of 500,000 pounds of antimony. Operations could be sustained for several years if lower-grade ore could be economically beneficiated. Production would be significant in relation to U.S. antimony production (about 1,100,000 pounds in 1982) but not in terms of annual domestic consumption (66,400,000 pounds in 1982).

Other production could result from development of several small deposits of easily accessible veins and pods of massive stibnite by small surface operations. This ore could be shipped directly to consumers without further processing. Because of the geologic nature of the stibnite occurrences, it is doubtful that any single mine would be larger than the operation at Stampede which employed 30 people during peak production.

Stratabound Massive Sulfide Deposits

The Kantishna Hills study area is underlain by rocks permissive for the occurrence of stratabound massive sulfide deposits. Three distinct potential hot environments have been identified: (1) quartzite units within the Precambrian Birch Creek Schist, (2) black slate/schist terranes in the Birch Creek Schist and the Devonian Keevy Peak Formation, and (3) volcanogenic environments in the lower Paleozoic (?) Spruce Creek Sequence.

Based on geologic similarities to known mines and on geochemical and geophysical evidence, several prospects and occurrences in the study area are broadly analogous to major deposits. The Lloyd Prospect is hosted in a quartzite unit containing disseminated to semi-massive sulfides similar to Precambrian Belt mineralization found at the Troy Mine in Montana. The Red Dirt and Canyon Creek Occurrences (figure 4), first recognized during the 1983 season, occur in a shale-hosted sulfide environment similar to the black shale terrane of the Red Dog Deposit in northwest Alaska. Volcanogenic rocks predominate the Spruce Creek Sequence on Quigley Ridge, Glen Creek Basin, and the Spruce Peak-Kankone Ridge. Numerous occurrences of small stratiform sulfide zones indicate that the host environment is present for volcanogenic exhalative massive sulfide deposits similar in mode to the Delta Mineral Belt of the Eastern Alaska Range.

In the absence of subsurface information, none of the stratabound occurrences have been adequately explored. Similar occurrences elsewhere in Alaska are being actively prospected, and while probability of discovery of a minable deposit is statistically low, the size of potential deposits is large enough to justify considerable effort and risk. If the region were open to mineral entry and development, there would be exploration efforts in the area by major mining companies.

A shale-hosted massive sulfide deposit could contain tens of millions of tons of ore yielding 5% to 30% combined lead and zinc, recoverable silver, and possible credits of gold and other metals. A quartzite hosted deposit would characteristically contain plus or minus million tons. The ore could contain up to 10% copper, several percent zinc and lead, and significant silver and gold values.

If one of these deposits were found and developed, it could be of sufficient size and grade to support a large surface or underground mine emloying several hundred people. Annual production could be on the order of 500,000 tons of ore. The ore would be milled on site producing concentrates which would be shipped elsewhere for smelting and refining.

Other Deposits and Geochemical Anomalies

Significant mineral occurrences and geochemical anomalies were located by regional mapping and sampling during this study. Figure 5 shows major geochemical anomalies. Many of the anomalies can be explained by proximity to known occurrences. Significant new anomalies incude: (1) the Spruce-Kankone Trend, a 1983 discovery of a structurally-controlled base and precious metal zone that may have a strike length of 7,000 ft; (2) zinc anomalies associated with black shales and schist units of the Birch Creek and Keevy Peak Formations; (3) tungsten anomalies in the Canyon Creek drainages; (4) several scattered unexplained copper and zinc anomalies in the Birch Creek Formation.

Other deposits of interest include skarn deposits in the Iron Dome-Eldorado Creek areas and garnet-bearing amphibolites containing minor free gold in the Birch Creek Formation.

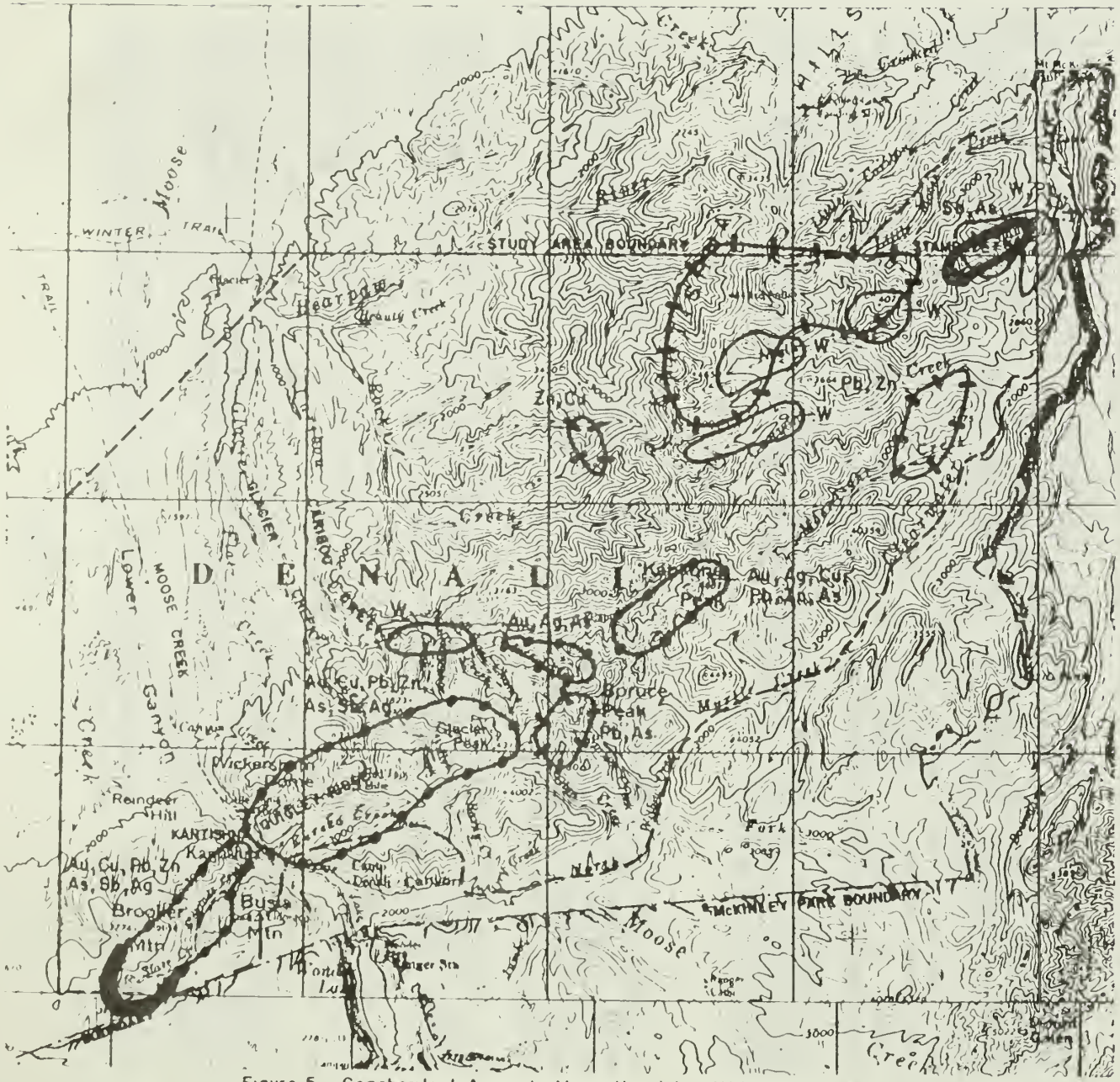
DUNKLE AREA

At least four high-grade gold-silver vein deposits occur in the study area along the zone or on associated structures. The vein deposits are narrow and strike lengths are known. This type of target is probably not attractive to major companies, but mining may be profitable on a modest-scale by small companies or individuals.

The shear zones in which the high-grade veins are located may contain lower-grade precious metal mineralization across sufficient width to permit bulk-mining. Such deposits could be of considerable interest to larger companies.

The Golden Zone Mine (figure 1) is a gold deposit associated with a breccia pipe located several miles west of the study area. The mine has produced in the past, and is currently being evaluated by private industry. The deposit has a potential for several million tons of low to moderae grade gold ore. Geology, structure, and mineralogy associated with the igneous complex in the Dunkle Mine study area present an environment favorable for the occurrence of similar deposits. This interpretation is supported by geochemical and geophysical evidence (figures 7 and 8).

Several potential copper/molybdenum and copper/precious metal porphyry-type targets have been identified within the study area (figure 9). These targets



LEGEND

Primary Metals	Secondary Metals
Zinc, lead, copper	None
Antimony	Precious base metals
Silver, gold	Base metals and ant-
Tungsten	Base metals

Figure 5 - Geochemical Anomaly Map - Kantishna Hills Study Area

have not been adequately tested. If economic deposits of this type are found they could contain 10's or 100's of millions of tons of low grade ore.

Good quality coal has been mined from the Dunkle Mine (figure 6) within the study area. Minable reserves in the range of 100,000 to 350,000 tons are drill indicated. Additional reserves in the magnitude of several million tons may be identified with further drilling in the Costello-Colorado-Camp Creek basin. Small scale mining by open cut mining methods may be feasible.

The presence of auriferous gravels in several streams was confirmed during the 1983 project and small-scale placer mining may be feasible in some locatons.

Some geochemical evidence exists for antimony and tin mineralization. The potential for these minerals has not been adequately determined.

The Dunkle Mine study area is a highly metalliferous, geologically complex environment. The proximity of the Dunkle area to the railroad and the Parks Highway further enhances the favorability of the areas mining potential.

RECOMMENDATIONS

The Kantishna Hills and Dunkle Mine study areas are both highly mineralized regions. Should these areas be opened to mineral entry, either through a leasing program or mineral location, the result would be increased exploration and probable development by individual miners and major mining companies. In order for the ALUC to more accurately evaluate and determine the mining potential of the study areas, the following recommendations are made concerning future mineral evaluation activities.

- Kantishna Placer Deposits - The lower floodplains of Glacier, Caribou, and Lower Moose Creeks have developed broad terrace and floodplain deposits that contain auriferous stream-laid gravels. Upper Moose Creek contains both modern floodplain and older terrace gravels of stream and glacial origin. Limited testing indicates that the terrace and floodplain gravels contain recoverable gold constituting a resource of more than 200 million cubic yards of gravels. Should these gravels be economic, mining could occur as possible large-scale dredge operations with greater impact than the current stream operations. These gravels should be evaluated by rotary or churn drilling methods.

- Kantishna Massive Sulfide Deposits - The geologic environment in three distinct areas is favorable for deposition of massive sulfide deposits. Geochemical and geophysical anomalies and surface mineralization are present. Although statistically the chances for developing a mine are low, one of thse deposits could contain metal values measured in billions of dollars. A mine of this magnitude would have significant local impact and could produce metals in quantities that would effect world supply. Additional geochemistry and geophysics followed by core drilling is recommended.

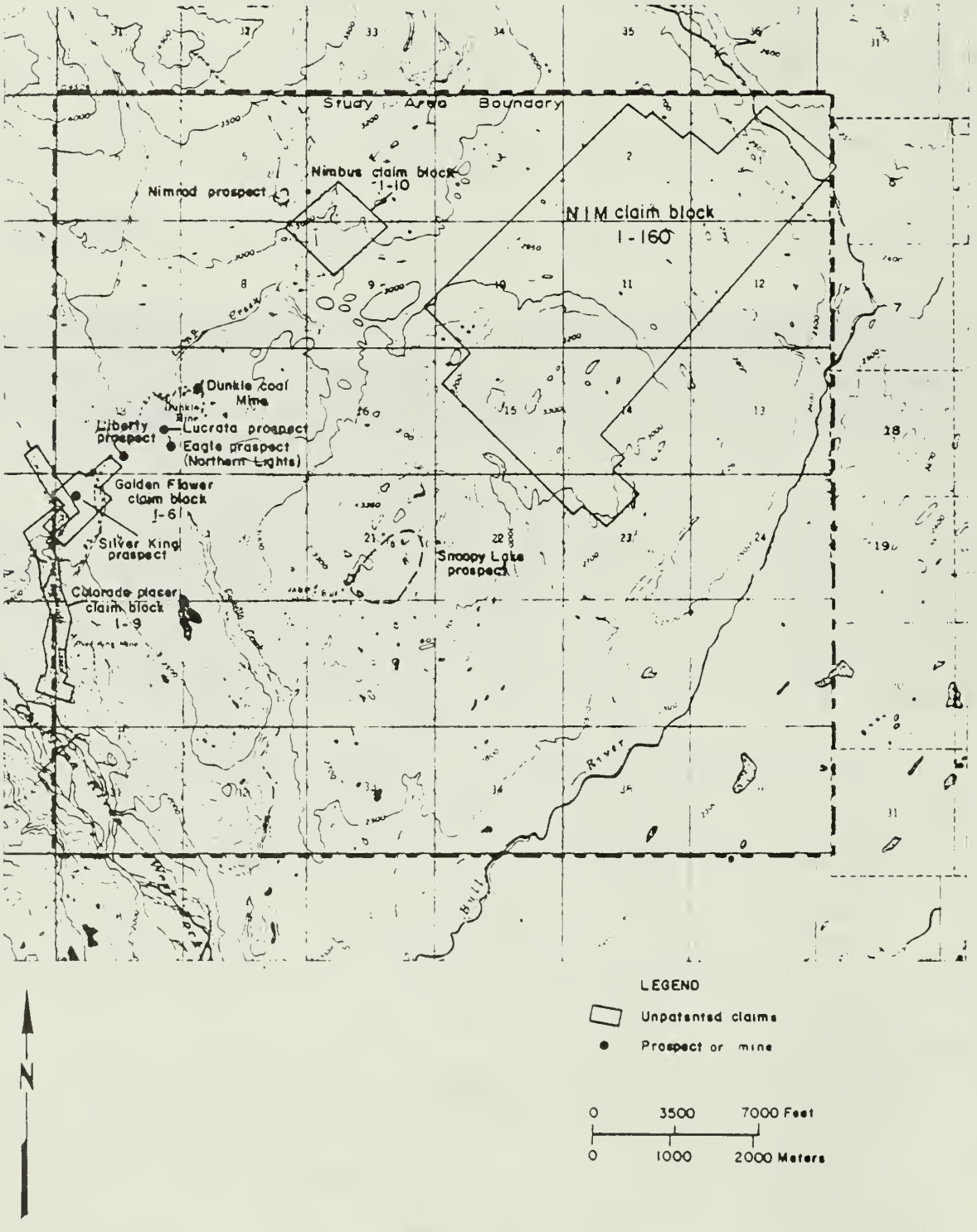


Figure D-2 Claims, Mines, and Prospects - Dunkle Mine Study Area

Figure D-3 Geochemically Anomalous Zones – Dunkle Mine Study Area

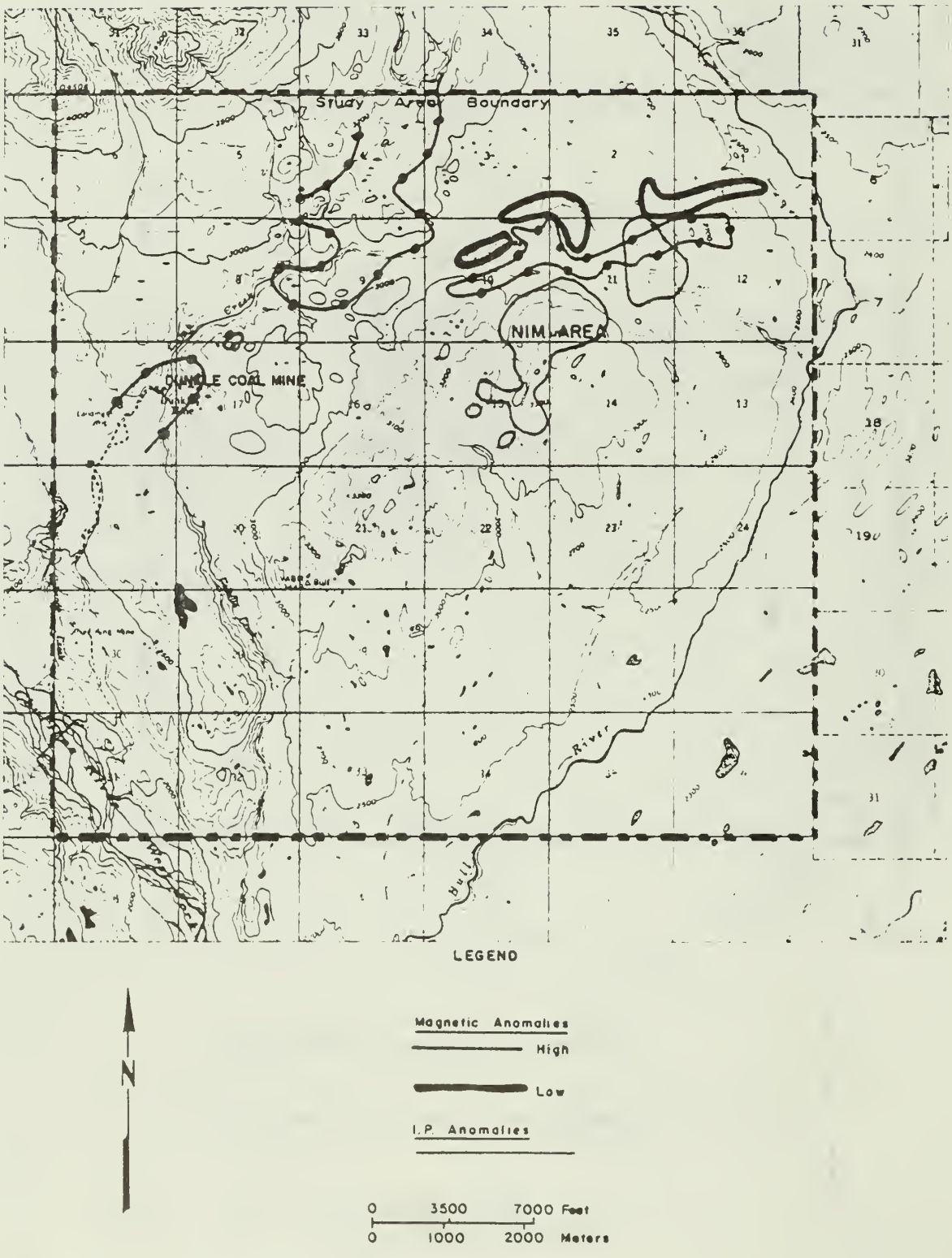


Figure D-4 Geophysically Anomalous Zones – Dunkle Mine Study Area

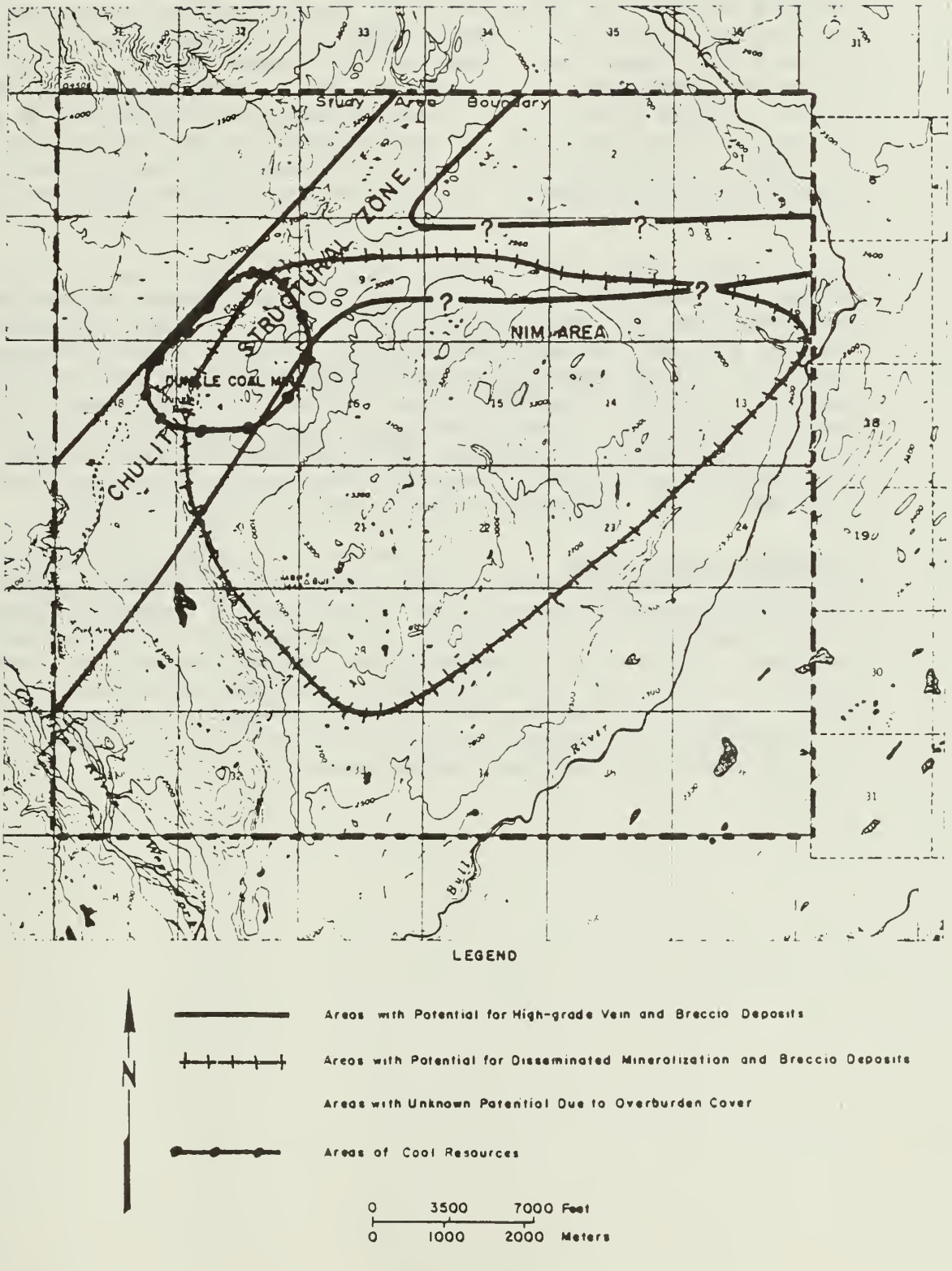


Figure D-5 Zones of Mineral Potential - Dunkle Mine Study Area

- Kantishna Lode Vein Deposits - Precious metal vein and antimony lode deposits account for the majority of the known lode occurrences in the Kantishna Hills study area. Many of the more promising occurrences are on unpatented claims or in unclaimed areas. A total of 113 mines, prospects, or occurrences were examined during the 1983 study. Of this number 76 are precious metal occurrences and 19 are antimony. The remaining 18 occurrences are stratiform massive sulfides, or sulfide showings for which data are insufficient for classification. In order to properly evaluate and establish reserve estimations, core drilling is required.

- Dunkle Mine Area - The Dunkle Mine study area has not been adequately evaluated. Although there are known mineral occurrences, and geochemical and geophysical targets, subsurface data are lacking because drilling was not allowed during the 1983 study. Geologically the area is favorable for bulk-tonnage base and precious metal deposits similar to the Golden Zone located a few miles west of the study area. There are also known coal reserves, high-grade precious metal vein systems, and possibly porphyry-type deposits. Access to rail and highway is only a few miles southeast of the study area. Core drilling is recommended prior to final land use decisions.

- Kantishna and Dunkle - Large areas of overburden containing geochemical anomalies exist in both study areas. Airborne magnetic and electro-magnetic surveys are recommended to further delineate these anomalies and better explain the geologic controls of mineralization. Structural interpretation and delineation of buried intrusives could also benefit from this program. Large areas of the Birch Creek Schist terrane have not been adequately studied in the Kantishna area. An airborne magnetic/electro-magnetic program could form the basis for additional detailed work.

APPENDIX IV

Basic Mineral Development Scenarios

Kantishna Hills and Dunkle Mine Study Areas

Mineral Development Scenarios
Kantishna Hills and Dunkle Mine Study Area

The Mineral Development Scenarios as outlined below attempts to identify the types of mineral activity which could reasonably be assumed to occur given the assumption that the study areas are open to further exploration, staking of mining claims and development. To facilitate evaluation of the alternatives in the FEIS, development likely to occur on and off claims are shown in separate adjacent columns.

Kantishna Hills Study Area

Mineral development in the Kantishna Hills Study Area can reasonably be predicted to include placer mining, lode gold, silver, and antimony mining and continued exploration for potential stratiform Pb-Zn, skarn, and disseminated precious metal deposits.

Placer mining will range in size from small suction dredge operations capable of processing a few cubic yards of gravel a day to large, integrated mechanized equipment feeding recovery plants with capacities of up to 3,000 cubic yards of material per day. Currently identified precious metal deposits in the Alpha Ridge, Quigley Ridge, Wickersham Dome and Glen Creek areas will be developed using small scale-high grading capable of producing from 1-5 tons of ore per day. Ore could be concentrated at the current Red Top Mill or taken to Fairbanks for concentration. Silver predominant veins in the Quigley Ridge area may be mined by underground techniques and supply up to 150 tons of ore per day to a mill located on the east side of lower Friday Creek. Gold predominant veins in the Banjo Mine area could be mined by underground techniques and supply up to 110 tons of ore per day to a mill located near the present Banjo Mill site. Antimony deposits located on Slate Creek, Caribou Creek, and in the Stampede area will support small high grading operations capable of producing from 1-5 tons of ore per day. In addition, it is reasonable to predict that at least one of the antimony deposits could support an underground operation which would supply up to 55 tons of ore per day to a nearby mill.

Mineral resource studies completed in 1983 produced additional evidence in favor of the presence of potentially large stratiform Zn-Pb sulfide and disseminated precious metal deposits. Further exploration for these deposits is anticipated depending upon future land status within the study area.

For purposes of the following analysis, it is assumed that 35 ton ore trucks would be used to haul concentrates to railhead at the Park entrance for both of the precious metals mines and the antimony mine and that tanker trucks would have an 8,000 gallon capacity. Plant infrastructure requirements are similar to those proposed by Jansons and others (1977), Cummings and Bruce (1977), and Louis Berger and Associates (1982) for northern mining developments. Mine size models are based upon recent feasibility studies by U.S. Bureau of Mines, Alaska Field Operations Center, Anchorage, Alaska, and levels of 1983 mining activity observed in the Kantishna Hills Study Area.

1. Placer Mining

Existing Claims Only	Existing and Unclaimed Areas
Location: Moose Creek, Eureka Creek, Friday Creek, Glacier Creek, Glen Creek, Rainy Creek, Eldorado Creek.	Same plus Little Moose Creek, Stampede Creek, Clearwater Fork.
Number of Operations: 15-25 per year	25-35 per year
Production: 5,000-7,500 oz gold/year 1,200-1,500 oz silver/year from 500,000 cubic yards of gravel	8,000-12,000 oz gold/year 2,000-3,000 oz silver/year from 1,000,000-2,000,000 cubic yards of gravel
Mining Methods: Suction Dredges, Backhoe or Loader Fed Washing Plants	Same. However, large scale operations using scrapers for overburden removal could be used.
Operating Period: Late May-Early October	Same
Mine Life: 20-25 years (current reserves) 50-60 years (reserves and identified resources)	Up to 40 years (current reserves and identified resource) Up to 200 years (if unevaluated resources included.)
194 placer claims cover about 5,000 acres. Up to 1/3 of this acreage is likely to be mined.	
Personnel: 2-12 people/operation (including family) (Total - 100-120)	2-20 people/operation (Total - 120-200)
Support/Supplies: 3-5 vehicles/day - miners 2 fuel trucks/week Families and mine personnel will live on site in trailers.	5-10 miners vehicles/day 3-4 fuel trucks/week Families and mine personnel will live on site in trailers.

2. Lode Mining - Pocket High Grading of Precious Metal Veins

Existing Claims Only	Existing and Unclaimed Areas
Location: Quigley Ridge, Wickersham Dome, Eldorado Creek, Glen Creek	Same plus Upper Caribou Creek
Number: 1-3 per year (estimate that 4-6 deposits of this type occur on current claims)	1-3 per year (estimate that an additional 4-6 deposits could be found on potential claims)
Production: 120-600 oz gold, 5,000-25,000 oz silver from 120-600 tons ore produced per year.	Same
Mining Method: Surface excavation using back-hoe, percussion drill, and explosives to obtain hand cobbed high-grade shipping ore. Ore could be upgraded at current Red Top Mill.	Same
Operating Period: May-October	Same
Mine Life: Each deposit would support an operation lasting 1-3 years.	Same
Access: Current roads and trails would be utilized. Ore could be transported by air to central point (Red Top Mill) and by truck over existing roads to market.	Additional road and trails would be required, existing roads may require upgrading.
Personnel: 2-5 men per operation.	Same
Support and Supplies: Comparable to impact from an existing placer mine.	Same

3. Lode Mining - Pocket High Grading of Antimony Veins

Existing Claims Only	Existing and Unclaimed Areas
Location: Slate Creek, Last Chance Creek	Same plus Glen Creek, Stampede Area
Number: 1-2 per year	Same
Production: 65-350 tons of antimony metal from 120-600 tons ore/year/ operaion	Same
Mining Method: Surface excavation using back-hoe, percussion drill, and explosives to obtain hand cobbed high grade shipping ore.	Same
Operating Period: May to Early October	
Mine Life: Each deposit could support an operation for 1-5 years.	Same
Access: Current roads and trails would be utilized.	Same
Support and Supplies: Comparable in impact to an existing placer mine.	

4. Lode Mining: Silver Predominant Vein Deposit (see BOM Feasibility Report Appendix VI)

Location:

Mine: Quigley Ridge, would require about 5 acres for roads and adit sites.

Mill: Near current location of Red Top Mill would require about 5 acres. Stock piling would be necessary if shipments could not be made year-round. Would require large warehouse.

Housing, Sewage, & Waste Disposal: Needed to support workers and their families. Could be built on Moose Creek flood plain. Would require large warehouse.

Tailings Pond: Located below current Red Top Mill site; would require about 25 acres.

Personnel:

40 mine and mill employees plus an estimated 60 dependents.

Number:

1 mine is evaluated. There is lower probability of additonal mines being developed at other locations.

Production: Assumes a mining rate of 150 tons/day 49,500 tons/year yielding

2,000,000 ounces silver/year
7,000 ounces gold/year
4,000,000 lbs lead/year
1,650,000 lbs zinc/year

Mining Method:

Underground shrinkage stoping. Ore hauled to portal by battery-powered locomotive. Transport ore to mill from two separate portals using 10-ton trucks over existing upgraded roads.

Milling Method:

Gravity and floatation circuits to produce gold and silver bearing lead-zinc concentrates. Water for mill would be supplied by wells.

Operating Period:

330 days

Mine Life:

6 years based upon 297,000 tons of reserves. Mining would likely result in the discovery of additional reserves, prolonging the mine life of the operation.

Access:

Mostly using current upgraded roads. However, the construction of a northern route along the route of the Stampede Road would reduce impacts upon Denali National Park and Preserve and may be necessary to insure a year-round operation.

Support and Supplies:

8,000 tons of concentrates produced/year would require 225 round-trip truckloads to Alaska Railroad on existing Denali Park road or the Stampede Road corridor. Aircraft transport could reduce truck transport requirements but may not be economically preferable.

350,000-450,000 gallons per season of #1 stove fuel equivalent would be needed to provide power for mine, mill and housing. This would require 45-55 tanker-truck trips per year.

400 tons of supplies, at a minimum would be hauled in per season to support operations (food, explosives, parts, floatation reagents, tires, etc).

5. Lode Mining: Gold Predominant Vein Deposit (see BOM Feasibility Report Appendix VI)

Location:

Mine: Lucky Gulch Area, 3 acres required for roads and adit site

Mill: Lucky Gulch - Eureka Creek Area - would require 2 acres

Housing, including Sewage, & Waste Disposal: Located on north side of Eureka Creek near junction with Lucky Gulch. Would require about 10-acre site.

Tailings Pond:

Could be located on west side of Lucky Gulch near its junction with Eureka Creek; would require about 5 acres.

Personnel:

35 mine and mill employees plus an estimated 50 dependents.

Number:

1 mine is evaluated. A lower probability of additonal mines being developed exists elsewhere.

Production: Assumes a mining rate of 110 tons/day 36,300 tons/year.

16,500 ounces gold/year
110,000 ounces silver/year
400,000 lbs lead/year

Also, an unevaluated but possibly significant amount of tungsten would be produced from this mine. Sampling (S & D, 1983) indicated grades of greater than 0.03% tungsten.

Mining Method:

Underground shrinkage stopes. Ore hauled to portal by battery-powered locomotive and to mill by tram or 10-ton trucks over existing upgraded roads.

Milling Method:

Gravity and floatation circuits would be used to produce free gold and a gold-silver bearing lead concentrate. 2,180 tons of concrete would be produced per year. Water for the mill would be supplied from wells located nearby or by water impoundments.

Operating Period:

330 days

Mine Life:

5 years based upon 181,500 tons of reserves. Additional reserves would likely be identified during mining, prolonging the mine life.

Access:

Existing but upgraded roads would be used. However, use of the Stampede route would reduce impact on Denali National Park and Preserve.

Support and Supplies:

2,180 tons of concentrates produced/year would require 65 round-trip truckloads to an Alaska Railroad railhead. Aircraft transport could reduce truck transportation requirements but may not be economically preferable.

275,000-35-,000 gallons per season of #1 stove fuel equivalent would be needed to provide for power requirements. This would require 35-45 tanker-truck round-trips per year.

400 tons of supplies, at a minimum would be hauled in per season to support operations (food, explosives, parts, floatation reagents, tires, etc).

6. Lode Mining: Antimony Vein Deposit (see BOM Feasibility Report Appendix VI)

Location:
Should the demand for antimony improve several deposits could conceivably support a mine of the size modeled. However, one of these could likely fill the demand. Infrastructure required for the mine would cover about 10 acres.

Personnel:
36 mine and mill employees plus 25 dependents.

Number:
1

Production:
1,500 lbs of antimony metal/year from about 6,600 tons of ore.

Minor by-product gold and silver could be recovered.

Mining Method:
Underground overhand stoping. Ore hauled to portal by battery-powered locomotive and to mill by 5-ton truck.

Milling Method:
Floatation would be used to produce a salable (60%) antimony concentrate

Operating Period:
120 days

Mine Life:
5 years based upon 33,000 tons of reserves. Additional reserves would likely be identified during mining, prolonging the mine life. Note: resource estimate for Stampede Mine is 450,000 tons.

Access:
Existing roads could be upgraded for use.

Support and Supplies:
1,200 tons of concentrates produced per year would require 35 round-trip truckloads to an Alaska Railroad railhead. Air transport could reduce truck transportation requirements but may not be economically preferable.

50,000-75,000 gallons of #1 stove fuel equivalent would be needed for power requirements. This would require 5-10 tanker truck round-trips per year.

150 tons of supplies would be hauled in per season to support the operation.

APPENDIX V

ADNR, DGGS Probabilistic Regional Mineral Assessment Study

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

ADNR, DGGS Probabilistic Regional Mineral Assessment Study

The Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys has developed a method for appraising regional mineral endowment (identified and undiscovered resources) and has applied it to both the Kantishna Hills and Dunkle Mine study areas. This method employs a probabilistic approach to utilizing expert geologic judgement to evaluate the mineral potential of a selected metalliferous terrane. The products of an assessment include ranges (probability distributions) for the quantities of mineral commodities (e.g. gold, copper, tungsten, etc.) that may exist in the area and the proportions (in dollar values) that could be economically produced. Expert geologists and engineers from ADNR, Bureau of Mines, USGS, and contractors participated in this assessment making use of both the 1983 field work and past studies.

The total recoverable value of known and undiscovered mineral resources in the Kantishna Hills study area ranges from $375 million to $1,260 million at the 95 percent and 5 percent confidence levels, respectively. In the Dunkle Mine study area, excluding coal resources, the values range from 0 to $840 million at the 95 percent and 5 percent confidence levels, respectively. Results are listed on Tables 1 and 2.

TABLE 1. - Economically Recoverable Resource Summary for the Kantishna Hills Study Area
(DGGS Probabilistic Mineral Resource Assessment Method)

Deposit Type	Recoverable Resources				Recoverable Value ($ Millions)			
	Average	95%	50%	05%	Average	95%	50%	05%
Vein (Au)								
Spruce Ore (10E6 tons)*	.4	.1	.3	.9	122.0	26.4	100.4	288.8
Au (10E3 oz)	167.9	35.7	150.7	464.9	78.2	18.9	62.7	193.5
Ag (10E3 oz)	2,318.8	272.0	1,673.4	6,424.6	28.1	3.3	20.2	77.7
W (tons)	583.1	.4	324.8	2,074.2	15.7	.6	8.8	56.0
Vein (Ag)								
Spruce Ore (10E6 tons)	1.0	.5	.9	1.7	533.0	250.6	490.5	957.4
Ag (10E3 oz)	28,939.4	12,660.4	26,071.7	55,307.2	350.2	153.2	315.5	669.2
Au (10E3 oz)	217.3	70.8	182.0	475.0	90.4	29.5	75.8	197.7
Pb (10E3 tons)	114.6	39.1	95.5	259.3	43.5	14.4	36.3	98.6
Zn (10E3 tons)	59.6	18.4	50.7	129.3	48.9	15.9	41.6	106.1
Placer								
Alluvial (10E6 tons)	3.1	.0	1.7	10.6	15.1	.0	8.3	50.7
Au (10E3 oz)	35.0	.0	19.0	118.8	14.6	.0	7.9	49.4
Ag (10E3 oz)	10.4	.0	4.4	42.4	.1	.0	.1	.5
W (tons)	12.6	.0	.0	72.9	.3	.0	.0	2.0
Placer								
Benches (10E6 tons)	15.6	.0	.5	85.0	44.3	.0	1.7	234.2
Au (10E3 oz)	105.1	.0	4.1	557.6	43.8	.0	1.7	232.1
Ag (10E3 oz)	43.0	.0	.8	259.6	.5	.0	.0	3.1
Stratiform								
Shale-Host (10E6 tons)	.8	.0	.0	.0	68.6	.0	.0	.0
Pb (10E3 tons)	.4	.0	.0	.0	.5	.0	.0	.0
Zn (10E3 tons)	78.6	.0	.0	.0	68.4	.0	.0	.0
Ag (10E3 oz)	.0	.0	.0	.0	.0	.0	.0	.0

TABLE 1. - Economically Recoverable Resource Summary for the Kantishna Hills Study Area (DGGS Probabilistic Mineral Resource Assessment Method) - Continued

Deposit Type	Recoverable Resources				Recoverable Value ($ Millions)			
	Average	95%	50%	05%	Average	95%	50%	05%
Stratiform								
Spruce Ore (10E6 tons)	.1	.0	.0	.0	6.8	.0	.0	.0
Au (10E3 oz)	5.9	.0	.0	.0	2.5	.0	.0	.0
Ag (10E3 oz)	37.2	.0	.0	.0	.4	.0	.0	.0
Cu (10E3 tons)	1.8	.0	.0	.0	2.9	.0	.0	.0
Zn (10E3 tons)	1.2	.0	.0	.0	1.0	.0	.0	.0
Pb (10E3 tons)	.0	.0	.0	.0	.0	.0	.0	.0
Regional Totals								
Ore (10E6 tons)	21.0	1.3	6.4	91.4	785.8	374.5	682.4	1,261.3
Au (10E3 oz)	551.3	213.4	479.3	1,112.4	229.5	88.8	199.5	463.0
Ag (10E3 oz)	31,349.1	14,304.0	28,597.6	58,022.9	379.3	173.1	346.0	702.1
W (tons)	595.6	.0	335.4	2,092.9	16.1	.0	9.1	56.5
Pb (10E3 tons)	115.0	39.1	95.5	259.4	43.7	14.8	36.3	98.6
Zn (10E3 tons)	139.4	19.8	51.7	151.8	114.3	16.2	42.8	124.5
Cu (10E3 tons)	1.8	.0	.0	.0	2.9	.0	.0	.0

* E - Exponent 10E6 is one million
10E3 is one thousand

TABLE 2. - Economically Recoverable Resource Summary for the Dunkle Mine Study Area
(DGGS Probabilistic Mineral Resource Assessment Method)

Deposit Type	Recoverable Resources				Recoverable Value ($ Millions)			
	Average	95%	50%	05%	Average	95%	50%	05%
NIM								
Dunkle (10E6tons)*	.8	.0	.0	5.6	119.0	.0	.0	679.6
Cu (10E3 tons)	8.5	.0	.0	39.6	13.6	.0	.0	63.4
Ag (10E3 oz)	2,157.2	.0	.0	12,583.0	26.1	.0	.0	152.2
Au (10E3 oz)	190.6	.0	.0	1,083.5	79.4	.0	.0	451.0
Porphyry								
Dunkle (10E6 tons)	.9	.0	.0	.0	31.9	.0	.0	.0
Cu (10E3 tons)	4.9	.0	.0	.0	7.8	.0	.0	.0
Mo (10E3 tons)	1.2	.0	.0	.0	24.0	.0	.0	.0
Vein/Skarns								
Dunkle (10E6 tons)	.0	.0	.0	.0	2.9	.0	.0	.0
Au (10E3 oz)	6.7	.0	.0	32.7	2.8	.0	.0	13.6
Ag (10E3 oz)	7.7	.0	.0	55.6	.1	.0	.0	.7
Regional Totals								
Ore (10E6 tons)	1.6	.0	.0	6.2	153.8	.0	1.2	840.3
Cu (10E3 tons)	13.4	.0	.0	48.9	21.4	.0	.0	78.2
Ag (10E3 oz)	2,164.9	.0	.0	12,599.8	26.2	.0	.0	152.5
Au (10E3 oz)	197.3	.0	1.8	1,092.0	82.1	.0	.8	454.5
Mo (10E3 tons)	1.2	.0	.0	.0	24.0	.0	.0	.0

* E - exponent 10E6 is one million
10E3 is one thousand

APPENDIX VI

Kantishna Feasibility Studies - Bureau of Mines

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Kantishna Feasibility Studies - Bureau of Mines

Gold, silver, and antimony lode deposits in the Kantishna Hills were modeled based on reserve estimates and grades published by ADNR, DGGS (1983). Discounted cash flow analyses were performed to determine possible rates of return which are applicable only if reserves and grades are proven.

Capital and operating costs were estimated by the Bureau of Mines Cost Estimating System and fall within ± 25% of actual costs. Discounted Cash Flow Analyses and Monte Carlo Simulation was done using the Bureau of Mines MINSIM program. Monte Carlo Simulation involved varying the capital and operating costs and commodity prices independently and calculating rate of return.

The gold mine modeled processed 110 tons of ore per day and had 181,500 tons of reserves containing 0.54 oz/ton gold, 3.59 oz/ton silver, and 1% lead. After 1,000 simulations the mine yields a mean rate of return of 14.4%. At September 1983 mineral commodity prices 1/ the model yields a 4% rate of return on investment.

The silver mine modeled processed 150 tons of ore per day and had reserves of 297,000 tons containing 0.17 oz/ton gold, 41.4 oz/ton silver, 4.16% lead, and 1.7% zinc. After 1,000 simulations the mine yields a mean rate of return of 44.5%. At September 1983 mineral commodity prices a 39% return on investment is realized.

The antimony mine modeled processed 55 tons of ore per day and had 33,000 tons of reserves containing 12% antimony. After 1,000 simulations the model yields a mean rate of return of 8.5%. At September 1983 mineral commodity prices a 1% return on investment is indicated.

The Bureau of Mines (Bureau) used previous resource estimates of Bundtzen (1983) and new data acquired under contract to Salisbury & Dietz, Inc. of Spokane, Washington, to develop a half-square resource estimate for lode vein deposits in the Kantishna Hills study area. Salisbury & Dietz, Inc. and Bureau data were used to estimate the placer resource potential of the study area. Results are included as Table 3. Bureau estimates of the proportion of identified resources on and off existing claims is included as Table 4.

An estimate of the mineral resources present in the Dunkle Mine study area prepared by Bundtzen (1983) was updated using Salisbury & Dietz, Inc., data and included as Table 5.

1/ September prices used in calculations: Gold - $415/oz; Silver - $12/oz; Lead - $0.24/lb; Zinc - $0.45/lb; Antimony - $1575/ton of 60% Sb concentrate.

NAME: KANTISHNA HILLS LODE GOLD MINE 110 tons/day

Reserves - 181,500 tons
Operating Days/Year - 330
Mine Life - 5 years

Mine Personnel - 25
Mine Personnel - 10

INVESTMENT SUMMARY

Exploration -	$ 277,000
Land Acquisition -	46,300
Development -	1,565,000
Mine Equipment -	470,300
Mine Plant -	1,173,000
Mill Plant -	4,495,800
Working Capital -	940,500
Camp -	122,500
Total	$9,090,400

Mine Operating Cost -	$ 94.45/ton
Mill Operating Cost -	$ 47.75/ton
Total	$142.20/ton

Summary of Operation: Mining of 110 tpd of ore will be done using shrinkage stopes. Haulage will be by battery locomotive.

Milling will consist of gravity and floatation circuits which will produce free gold and a gold and silver-bearing lead-concentrate.

Resoures: Resources are hypothetical due to lack of subsurface data.

COMMODITY DATA

Commodity	Ore Grade	Mill Recovery	Price
Gold	0.54 oz/st	85%	$415/oz
Silver	3.59 oz/st	85%	$ 12/oz
Lead	1.0%	60%	$0.24/lb

Total Revenues over mine life - $42,450,035

Total State Tax over mine live - $414,531

Total Federal Tax over mine life - $1,935,697

Discounted cash flow rate of return - 4.3%

TABLE 1. Gold price required to obtain a given rate of return, Kantishna Lode Gold Mine. Lead price is held constant at $0.24/lb and silver varies from $5.00 to $20.00/oz.

Silver Price $/oz	0	5	10	15	20	25
5.00	437.81	464.81	491.78	520.21	549.73	582.17
10.00	405.15	431.61	459.13	487.56	517.07	549.52
15.00	372.50	398.96	426.47	454.90	484.42	516.86
20.00	339.84	366.30	393.82	422.25	451.76	484.21
	Required Gold Price $/oz					

PCT RATE OF RETURN	PERCENT OCCURRENCE	
6	0.1	*
7	0.4	*
8	0.6	*
9	1.7	**
10	3.0	***
11	6.2	******
12	9.2	*********
13	12.4	************
14	17.5	*****************
15	15.6	****************
16	13.7	**************
17	9.5	**********
18	6.2	******
19	2.3	**
20	1.1	*
21	0.5	*

MEAN PCT RATE OF RETURN = 14.40

Figure 1. Expected distribution for percent rate of return based on 1000 Simulations. Kantishna Hills Gold Mine model.

PCT RATE OF RETURN	PERCENT OCCURRENCE	
20	0.1	*
23	0.2	*
24	0.4	*
26	0.1	*
27	0.2	*
28	0.2	*
29	0.9	*
30	0.7	*
31	1.0	*
32	1.4	*
33	1.6	**
34	1.2	*
35	2.3	**
36	2.3	**
37	3.1	***
38	3.2	***
39	3.7	****
40	3.7	****
41	5.7	******
42	5.4	*****
43	4.4	****
44	5.3	*****
45	5.7	******
46	6.1	******
47	6.1	******
48	5.1	*****
49	6.3	******
50	4.4	****
51	3.9	****
52	3.3	***
53	3.4	***
54	2.2	**
55	2.4	**
56	1.4	*
57	1.5	**
58	0.3	*
59	0.4	*
60	0.1	*
61	0.1	*
63	0.1	*
64	0.1	*

MEAN PCT RATE OF RETURN = 44.50

Figure 2. Expected disribution for percent rate of return based on 1000 simulations. Kantishna Hills Silver Mine model.

NAME: KANTISHNA HILLS LODE SILVER MINE 150 tons/day

Reserves - 297,000 tons
Operating Days/Year - 330
Mine Life - 6 years

Mine Personnel - 30
Mine Personnel - 10

INVESTMENT SUMMARY

Exploration -	$ 289,000
Land Acquisition -	185,200
Development -	6,329,400
Mine Equipment -	471,500
Mine Plant -	892,400
Mill Plant -	4,498,200
Working Capital -	1,122,500
Camp -	128,000
Total	$13,916,200

Mine Operating Cost -	$ 86.77/ton
Mill Operating Cost -	$ 50.71/ton
Total	$137.48/ton

Summary of Operation: Mining of 150 tpd of ore will take place at two portals. Stoping will be by shrinkage stope methods and haulage by battery locomotive. Ore from one mine site will be trucked to the mill which will be located at the other portal.

Milling will consist of gravity and floatation circuits which will produce free gold and a gold and silver-bearing lead-concentrate.

Resoures: Reserves and grades were modeled after half-square estimates by Bundtzen.

COMMODITY DATA

Commodity	Ore Grade	Mill Recovery	Price
Gold	0.17 oz/st	70%	$415/oz
Silver	41.4 oz/st	80%	$ 12/oz
Lead	4.6%	60%	$0.24/lb
Zinc	1.7%	30%	$0.45/lb

Total Revenues over mine life - $138,817,579

Total State Tax over mine life - $4,809,763

Total Federal Tax over mine life - $17,127,563

Discounted cash flow rate of return - 38.7%

NAME: KANTISHNA HILLS ANTIMONY MINE 55 tons/day

Reserves - 33,000 tons
Operating Days/Year - 120
Mine Life - 5 years

Mine Personnel - 27
Mine Personnel - 11

INVESTMENT SUMMARY

Exploration -	$ 287,000
Land Acquisition -	50,300
Development -	662,300
Mine Equipment -	161,200
Mine Plant -	788,400
Mill Plant -	1,902,000
Working Capital -	585,700
Camp -	
Total	$4,436,600

Mine Operating Cost -	$101.24
Mill Operating Cost -	$ 50.02
Total	$151.26

Summary of Operation: Mining of 55 tpd of ore will be by overstoping. Haulage will be by battery locomotive.

Milling will consist of floatation to produce a salable 60% antimony concentrate.

Resoures: Based on half-square estimates of Bundtzen.

COMMODITY DATA

Commodity	Ore Grade	Mill Recovery	Price
Antimony	12%	84%	$1575/ton (60% Sb conc.)

Total Revenues over mine life - $9,771,300

Total State Tax over mine live - $ 98,126

Total Federal Tax over mine life - $ 191,870

Discounted cash flow rate of return - 1.0%

TABLE 2. Required antimony concentrate price for a given rate of return Kantishna Antimony Mine Model.

ROR (%)

$/ton of 60% Sb concentrate	0	5	10	15	20	25
	1537.75	1721.71	1912.96	2113.51	2326.95	2556.30

PCT RATE OF RETURN	PERCENT OCCURRENCE	
0	0.1	*
1	0.4	*
2	1.0	*
3	2.6	***
4	3.0	***
5	6.0	******.
6	9.1	*********
7	12.5	**********
8	15.9	**********
9	12.3	**********
10	14.1	**********
11	10.8	**********
12	7.5	********
13	2.8	***
14	1.4	*
15	0.4	*
16	0.1	*

MEAN PCT RATE OF RETURN = 8.46

Figure 3. Expected distribution for percent rate of return based on 1000 Simulations. Kantishna Hills Antimony Mine model.

TABLE 3. - Half-Square Summation of Lode Vein and Placer Endowment for the Kantishna Hills Study Area

	Au (oz)	Ag (oz)	Pb (lb)	Zn (lb)	Sb (lb)	WO_3 (lb)
Precious-metal lodes (Quigley-Alpha Ridge-Banjo Mine Area)	150,000	15,358,000	80,215,000	40,403,000	127,000	420,000
Gold-silver base-metal veins (Spruce-Glenn Creek area)	5,900	676,000	1,947,000	840,000	679,000	
Primary antimony lodes (Stampede, Slate, and Last Chance areas)	3,100	35,000			133,787,000	
Subtotals	159,000	16,069,000	82,162,000	41,243,000	134,593,000	420,000
Placer Resource Estimate from High Potential Gravels on Present Claims	136,000	35,000				Possibly significant
Moderate and Undetermined Potential Gravels on Present Claims	153,000	38,000				Possibly significant
Additional Gravel Resources off Present Claims	955,000	240,000				Possibly significant
TOTALS	1,403,000	16,382,000	82,162,000	41,243,000	134,593,000	420,000

TABLE 4. - Summary of Total Mineral Resource Endowment on and off claims, Kantishna Hills Study Area

	Total Resource Endowment on Claims (1)	Average Estimated Probabilistic Resource Endowment Kantishna Study Area (2)	% of Total Estimated Resource off Claims
Gold	447,000 oz	822,000 oz	46%
Silver	16,104,000 oz	34,215,000 oz	53%
Lead	82,162,000 lbs	336,000,000 lbs	76%
Zinc	41,243,000 lbs	374,000,000 lbs	89%
Antimony	134,593,000 lbs	not evaluated	---
Tungsten (WO_3)	420,000 lbs	1,578,000 lbs	73%

1 Resource estimates based upon ADNR, DGGS and Bureau of Mines Half-Square resource estimates of precious metal and antimony vein deposits and Salisbury & Dietz estimates of placer resources.

2 Based upon ADNR, DGGS Probabilistic Resource Assessment of all deposits in the study area except antimony vein deposits.

TABLE 5. - Metallic Resource Estimates for the Dunkle Mine Study Area

Deposit Type	Name	Tons	Grade	Remarks
Vein shear zone	Eagle	12,000 3,000	0.23 oz/ton Au 4.55 oz/ton Ag (N=9)*	promising small deposits deserves additional work
	Lucrata	5,000	0.5 oz/ton Au 1.75 oz/ton Ag (5 samples)	same as above
	Liberty	-----	variable trace to 0.14 oz/ton Au 1.2 to 8.6 oz/ton Ag	low-grade Au-Ag lode
Breccia pipe	Silver King	85,000 minimum	trace to 8.29 oz/ton Au, contains Cu, Sb, Bi, As, Co, As, Sn Pb, An	several target areas known; poor exposure; needs additional work
	Nimbus		0.27 to 0.92 oz/ton Au	small vein deposit
	Nimrod	650,000 (1 target)	0.5 to 3 oz/ton Ag, credits of Pb, Zn, Sb	bulk-tonnage, low-grade Ag deposit
	NIM-Snoopy	speculative 500,000 - 2.5 million (5 targets)	anomalous Cu, Ag, Au As; may contain Sn, Bi	needs additional work
Porphyry	NIM	4,000 ft x 4,000 ft 100 to 120 million tons (low-grade)	anomalous cu, As, Au	lacks brecciation and silicification typical of this type of deposit

Source: ADNR, DGGS, 1983 updated by data from Salisbury & Dietz, in preparation
*N - Number of samples used to estimate grade

ALASKA KANTISHNA HILLS AND DUNKLE TOWNSHIP

ECONOMICALLY RECOVERABLE MINERAL SUMMARY

(PRELIMINARY)

NOVEMBER 1983

	RECOVERABLE RESOURCES				RECOVERABLE VALUE (Millions of Dollars)			
KANTISHNA HILLS	AVG	95%	50%	5%	AVG	95%	50%	5%
ORE(10E6 TONS)	21.0	1.3	6.4	91.8	785.8	374.5	682.4	1261.3
AU(10E3 OZ)	551.3	213.4	479.3	1112.4	229.5	88.8	199.5	463.0
AG(10E3 OZ)	31349.1	14304.0	28597.6	58022.9	379.3	173.1	346.0	702.1
W (TONS)	595.6	.0	335.4	2092.9	16.1	.0	9.1	56.5
PB(10E3 TONS)	115.0	39.1	95.5	259.4	43.7	14.8	36.3	98.6
ZN(10E3 TONS)	139.4	19.8	51.7	151.8	114.3	16.2	42.4	124.5
CU(10E3 TONS)	1.8	.0	.0	.0	2.9	.0	.0	.0
DUNKLE TOWNSHIP								
ORE(10E6 TONS)	1.6	.0	.0	6.2	153.8	.0	1.2	840.3
CU(10E3 TONS)	13.4	.0	.0	48.9	21.4	.0	.0	78.2
AG(10E3 OZ)	2164.9	.0	.0	12599.8	26.2	.0	.0	152.5
AU(10E3 OZ)	197.3	.0	1.8	1092.0	82.1	.0	.8	454.5
MO(10E3 TONS)	1.2	.0	.0	.0	24.0	.0	.0	.0

ALASKA DEPARTMENT OF NATURAL RESOURCES, DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

APPENDIX VII

DOWL/PLAN graphics Claim Acquisition Cost Study

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

DOWL/PLANgraphics Claim Acquisition cost Study

This report describes the methodology and results of estimating the present cost of acquiring mineral property interests in the Kantishna Hills and Dunkle Mine Study Areas of Denali National Park and Preserve. Previous studies by others have underestimated the value of acquiring these properties. The cost of acquiring both placer and lode claims based on current market value is estimated to be 157,000,000 million dollars. This acquisition cost includes the value of the patented surface estate.

Placer Claims	Estimated Cost of Acquisition ($)	
Kantishna	63,163,000	
Dunkle	66,000	
Sub-total		63,229,000
Lode Claims		
Kantishna (patented)	86,502,000	
Kantishna (unpatented)	7,477,000	
Kantishna (surface estate)	728,000	
Sub-total		93,979,000
TOTAL cost of acquisition (estimate)		157,208,000

Kantishna Hills Heavy Metal Investigations

CONCLUSIONS

RESULTS

Fish

The whole body analysis results for the Arctic grayling samples demonstrate similar results as in 1982.

In the few samples where tissue analysis was conducted separately for muscle, liver, and kidney, the muscle tissue displayed the lowest concentration of most heavy metals.

Grayling from mined stream areas generally exhibited higher metal concentrations than those collected from the control stream. Arsenic was perhaps the most notable with nine samples taken from mined streams having an average whole body arsenic concentration of .73 ug/g and five samples from the control stream averaging .02 ug/g arsenic.

Because of the relatively small sample size and the limitations on interpreting tissue changes, the results are of the histological examinations are inconclusive. They do, however, suggest that histopathological changes in Arctic grayling are more likely to occur, or occur more extensively, in mined stream areas compared to the control stream.

The hypertrophy, hyperplasia, aneurysm, and epithelial separation observed in the lamellae of the grayling, in this investigation, are relatively common nonspecific tissue reponses frequently associated with various chemical irritants including heavy metals, Ashley (1972), Eller (1975), Roberts (1978), and Malins, et al. (1982).

Further samples for histopathological examination could help provide more definitive results.

DISCUSSION and CONCLUSIONS

The followng are some general observations and conclusions based on the 1983 sampling effort in the Kantishna Hills:

1) Kantishna Hills streams have consistently neutral or above pH values ranging from 7.2 to 8.3.

2) Kantishna Hill streams have moderately hard to hard waters ranging from 100 to 300 mg/l of calcium carbonate. Only a few soft water sites (less than 75 mg/l) were measured.

3) Kantishna Hills stream temperatures were fairly low and consistent throughout the summer, the range being between 5 and 14 degrees Centegrade.

4) Dissolved oxygen was generally high in Kantishna Hills streams (8 to 11 mg/l).

5) Due to the ameliorating effects of high pH, hard waters, low water temperatures, and high dissolved oxygen, the Kantishna Hills stream biotic system has a relatively high tolerance to high levels of heavy metals.

6) A major problem in the Kantishna Hills mined streams is in the significant amount of settleable solids which enter below mining. Because the heavy metals are bound within and adhere to sediments, as long as settleable solids continue to enter the systems at high levels, metals will also.

7) Metal concentrations were usually found to be higher below mining operations than above operations.

8) Metal concentrations were found generally to be higher below mining operations than above operations.

9) Run-off from an abandoned mine had metal input into the stream but was not as great as from sampled active mines.

10) Settling pond dam breakage and dam improvement is reflected in downstream metal concentrations.

11) Natural erosion of metals during storm events does occur and was notable at some above mine sites.

12) Daily measurements at the Moose Creek bridge demonstrated that mining upstream affects the settleable solids and turbidity in Moose Creek at the bridge.

13) Initial dilution studies demonstrated that mined streams input metals to the Moose Creek system to differing degrees, and that natural erosional input also exists independent of the mined stream input.

The information collected in 1982 appears to be representative of heavy metals concentrations to be expected in the Kantishna Hills streams, based on the sampling completed in 1983. The findings presented in this report reinforce the previous investigations in demonstrating that many Kantishna streams have abnormally high levels of heavy metals, many above state and federal water quality criteria. The results further indicate that placer mining actively elevates the levels of most of the heavy metals sampled and that metal levels can be expected to be many times greater in receiving waters below placer mining compared to above. This was found to be mostly true when observing total metal levels, as much of the total was associated with the fine sediment particles, but was also evidenced in levels of dissolved metals. Table 11 offers a comparison of metal concentrations below mining to sites above mining.

Most of the metals sampled were found to be elevated as result of mining, but arsenic continued to stand out as a metal of particular concern. Arsenic appears to be associated with the pyrite deposits along with the placer gold in much of the region. The increase in dissolved arsenic in the mined areas may be as result of the bacterium Thiobacillus ferrooxidans which Brown, Luong, and Forshaug (1982) have found present in many interior Alaska streams and have associated its presence with high arsenic levels.

Metal levels found in the edible muscle tissue of the grayling sampled was not of concern and gutted fish taken from the area should not present a health hazard to those people who eat them. Some of the water in the area is probably good to drink at all times of the year, but a good rule to follow would be not to drink the water unless you are sure of its quality. If the water must be drunk, it should be filtered through a purifier, or at the very least, settled, and then boiled.

More investigations are necessary to demonstrate whether impact is occurring to Arctic grayling as result of heavy metals. This work should not only look at physiological response but also at threshold levels of avoidance which may not directly affect fish health but can restrict useable habitat. Other research should be directed at invertebrates as indicators of heavy metal toxicities and the potential of magnification of some metals through the food chain, the levels of metals bound in stream sediments, and continued monitoring of unmined streams with a potential for development so that a good baseline can be established.

Finally, technological changes need to be implemented wherever possible to reduce metal input from the mining operations. The high metal levels will perhaps never be eliminated, but there is a great deal of room for improvement.

APPENDIX IX

1982 & 1983 Reports of

The Alaska Department of Environmental Conservations's

Participation in the Kantishna Hills Study

Summary of Findings and Conclusions

SUMMARY OF FINDINGS AND CONCLUSIONS

The results obtained through the Alaska Department of Environmental Conservation's monitoring activities during the 1983 field study indicate that the State's Water Quality Standards and Waste Disposal Permit stipulations are being grossly exceeded as a result of placer mine wastewater discharge to streams in the Kantishna Hill's Study Area. Intensive water quality monitoring at four mining sites during the month of July, 1983, documented noncompliance with these standards and stipulations. The monitoring results, which are presented in this report, indicate that the "no measurable increase" limitation provided by the State's water quality standard for sediment was exceeded in a range from 206 mg/l to 3,885 mg/l. The State's water quality standard for turbidity was also measured to be exceeded in a range from 117 NTU's to 4,889 NTU's. In addition, the 0.2 ml/l/h settleable solids Waste Disposal Permit limitation was measured to be exceeded in a range from 0.4 ml/l/h to 28.8 ml/l/h. Although pollutant load balance computations performed with data collected during this investigation indicate substantial variability in effluent and receiving stream load estimates, measurement based effluent loading rate estimates indicate that the total suspended solid loads in wastewater discharged to the streams included in this investigation ranged from 224 lbs/h to 4,168 lbs/h. Similarly, measurement based estimates of turbidity loads in the wastewater discharged to these streams ranged from 1,762 ft^3.NTU's/s to 9,792 ft^3.NTU's and the measurement based estimates of settleable solids loads in the wastewater discharged to these streams ranged from 5.9 ft^3/h to 300 ft^3/h.

Substantial receiving stream increases in heavy concentrations were also documented during this investigation. Arsenic levels ranging from 150% to 2,420% of a value representing the potential water quality in streams receiving wastewater discharged and levels ranging from 105% to 1,840% of that value were measured in treatment pond effluent waters. Cadmium levels ranging from 290% to 740% of a value representing the potential water quality standard for cadmium were measured in streams receiving wastewater discharge and levels ranging from 150% to 370% of that value were measured in treatment pond effluent waters. Copper concentrations ranging from 143% and 307% of a value representing the potential water quality standard for that metal were also measured in streams receiving wastewater discharge. Iron concentrations ranging from 4,770% to 58,000% of a value representing the potential water quality standard for iron were measured in streams receiving wastewater discharge and levels ranging from 830% to 70,670% of that value were measured in treatment pond effluent waters. Manganese concentrations ranging from 940% to 13,200% of a value representing the potential water quality standard for manganese were measured in streams receiving wastewater discharge and levels ranging from 690% to 12,400% of that value were measured in treatment pond effluent waters. Nickel concentrations were found to be in excess of a value representing the potential water quality standard for nickel in one of the streams receiving effluent discharge and in the effluent waters discharged from two of the monitored operation's treatment ponds. Antimony was measured to be in excess of a value presenting the potential water quality standard for that metal in one of the streams receiving wastewater discharge. Values representing potential water quality standards for mercury and selenium were not found to be exceeded in either the receiving streams or the treatment pond effluent waters.

The results of anayses for heavy metals in both the dissolved fraction and the total concentrations indicate that the suspended fraction of seven of the nine metals (Sb, As, Cd, Cu, Fe, Mn, and Ni) ranged from 93% to 100% of the total concentration of those metals in the receiving stream and from 86% to 99.8% of the total concentration of those metals in the treatment pond effluent waters. Therefore, it appears that the heavy metals in these waters were associated with suspended sediments particles and that by removing the suspended particles from the wastewater or by preventing discharge of such sediment-laden wastewater, a substantial reduction in the receiving stream heavy metals concentrations can be achieved. Consequently, if the sediments and associated heavy metals are to be prevented from being discharged to these streams in the future, substantail improvements in wastewater treatment systems must be made. The inadequate attempts at treatment, which have been documented by this investigation, will obviously not assure compliance with sediment related and heavy metal water quality standards. Thus, the very apparent need for professionally designed treatment systems is the most notable conclusion of this study. Therefore, the recommendations for mitigating the excessive and unnecessary non-compliance with the water quality standards and water disposal permit limitations, as proposed in this report, emphasize adherence to existing regulatory procedures which require the submittal, review and approval of plans for professionally designed wastewater treatment systems. By utilizing these procedures, non-compliance may be prevented. It must be realized, however, that due to natural constraints, even professional design of adequate wastewater treatment systems may not assure compliance with all the applicable water quality standards in all situations. Therefore, if total compliance with existing water quality standards is anticipated, then mining must be limited to areas where adequate treatment systems can be installed and maintained.

APPENDIX X

Fish Resources and the

Effects of Mining Activities in the Kantishna Hills,

Denali National Park

1982 Reports

Summary and Conclusions

SUMMARY OF FINDINGS AND CONCLUSIONS

Findings

Eight fish species are known to occur in streams in the Kantishna Hills including Arctic grayling (Thymallus arcticus), slimy sculpin (Cottus cognatus), round whitefish (Prosopium cylindraceum), chinook salmon (Oncorhynchus tshawytscha), chum salmon (Oncorhynchus keta), coho salmon (Oncorhynchus kisutch), inconnu (Stenodus leucichthys), and northern pike (Esox lucius).

Arctic grayling and slimy sculpin were the most abundant and widespread species observed. Grayling occupy the upper reaches of major stream systems in spring and summer for spawning, rearng, and feeding. In the fall, they migrate downstream to overwinter in deep pools in the lower sections of streams. Some overwintering is also possible in a small lake at the headwaters of the North Fork of Moose Creek (hereinafter noted as North Fork Moose Creek or the North Fork). Slimy sculpins are believed to occupy the same general area of a stream throughout the year. Some short migration to deeper holes or springs for overwintering may occur, since many of the streams occupied are small and probably freeze solid.

Round whitefish were uncommon and were observed only in Moose Creek and North Fork Moose Creek in September while swimming upstream to spawn. Round whitefish that spawn in the upper Moose Creek drainage may spend the majority of the year in lower Moose Creek, Bearpaw River, or Kantishna River.

Chum salmon are known to spawn in Bearpaw River and lower Moose Creek. Small numbers of adult chum salmon were observed in Moose Creek near Kantishna and in the North Fork. All fish observed were males, and it is unknown whether any spawning occurred.

Chinook salmon are known to spawn in Bearpaw River, Glacier Creek, and Caribou Creek, and fry have been collected from lower Glacier and Caribou creeks.

Coho salmon, inconnu, and northern pike were not observed in 1982, but have been reported in Bearpaw River by previous investigators.

Placer mining has extensively altered large areas of riparian vegetation and aquatic habitat on at least 15 streams in the Kantishna Hills. Habitat alterations observed in the Kantishna Hills include removal of riparian vegetation, processing of stream gravels, channelization, straightening, channel diversion, road construction in streams, extremely high turbidity, sedimentation, litter, the construction of settling ponds, waterfalls, and other barriers to fish movement. Intensive mining and associated activities have altered up to 88% of the length of some streams and high turbidity has affected up to 100% of some streams.

Eureka, Glen, Friday, Spruce, Rainy, Eldorado, Yellow, and Caribou creeks have had the greatest degree of vegetation removal and channel manipulation. Arctic grayling abundance is consistently low in altered sections of these

streams (Yellow Creek not sampled) with Friday Creek not supporting any fish. It is also possible that Friday Creek may never have supported fish.

Accumulation of sediments from placer mining appeared greatest in portions of streams with lower gradients, such as the lower reaches of Moose, Spruce, Glen, Eldorado, and Glacier creeks. Eroded streambanks from past placer operations on Spruce, Glen, Rainy, and Eureka creeks still contribute sediments during heavy rainfall.

Turbidity measurements were dramatically lower in streams that had never been mined than in streams undergoing current mining. In addition, streams or stream reaches that had never been mined usually exhibited somewhat lower turbidity measurements than several streams with a previous history of extensive habitat alteration by placer mining activities.

Mining access roads run for considerable distances in the streambeds of Spruce, Glen, Eureka, Eldorado, and Slate creeks. Stream channels used as roads are typically shallow and unproductive and no fish were collected from these channels.

Fish barriers constructed to support placer mining activities were observed on three streams. A sluice box on Spruce Creek and a steep cascade at the mouth of Eldorado Creek may prevent upstream movement of some fish. A waterfall on Glen Creek prevents all fish movement into upper stream reaches.

Of the 34 streams or stream reaches that were examined in some detail, unaltered streams and stream reaches that still contain productive aquatic habitat include Moose Creek above the confluence of the North Fork, Section 9 Tributary to the North Fork, Willow Creek (North Fork tributary), Jumbo Creek, Eldorado Creek above the mouth of Slate Creek, unmined reaches of Caribou and Glacier creeks, and Rock Creek. These streams typically have high pool to riffle ratios, abundant riparian vegetation, ample instream cover, and a dense, slippery layer of algae and other periphyton on bottom substrates. Grayling abundance, as determined by electrofishing, was highest in streams with abundant periphyton, including North Fork Moose Creek, Jumbo Creek, and Eldorado Creek above the mouth of Slate Creek. These areas are presumed to be the major grayling spawning areas in the Moose Creek watershed, based on observations of large numbers of young of the year and/or adult sized fish. Significant grayling spawning is also believed to occur in the Caribou, Glacier, and Rock creek drainages, Moose Creek above the North Fork, confluence, and Section 9 Tributary to the North Fork.

Conclusions

The large study area, difficult access, and limited time and funding available for his project prevented in-depth, systematic evalutions of fish resources, aquatic habitat, and mining activities. Conclusions are based upon obvious trends or patterns observed through limited sampling on a large number of streams.

Because there are few quantitative historical records of fish abundance, it is not possible to directly compare pre-mining and post-mining fish populatons. Nevertheless, obvious differences in abundance and distribution between streams were observed that are almost certainly related to man-caused alterations in the quality of aquatic habitat. In most cases, grayling abundance in individual streams was inversely proportional to the degree of aquatic habitat alteration that has occurred. Summer feeding grayling populations were highest in unmined streams not subject to channel manipulation, high turbidity, or sedimentation from placer mining. Stream reaches that had been stripped of riparian vegetation and physically mined generally supported far fewer fish than unmined reaches experiencing only sedimentation and turbidity from upstream placer mining.

High stream gradient and natural barriers to migration appeared to be natural factors limiting fish distribution. Small, steep, turbulent streams with average gradients over 70 m/km were not observed to contain fish, probably because of insufficient cover, poor feeding habitat, and/or barriers to upstream movement.

Many of the effects of placer and lode mining activities on fish life history stages, spawning, migration patterns, behavior, and physiology are still poorly understood. This is particularly true with respect to increases in turbidity and toxic heavy metal concentrations.

Estimation of recovery periods for altered stream habitat is extremely difficult. Detailed information on pre-mining habitat quality and fish populations, and the nature and extent of past mining activity is largely unavailable. Recovery rates depend on the nature and extent of mining activity that has occurred. Gross changes in stream morphology and water quality as a result of placer or lode mining activities may, for all practical purposes, permanently alter the nature and inherent productivity of some streams.

The Kantishna Hills are unique within Denali National Park, with respect to the large number of clear water alpine streams in the area. Bearpaw River, Moose Creek, Glacier Creek, and Caribou Creek comprise most of the known salmon spawning streams in the park. Grayling in Kanishna Hills streams appear to be larger on the average than grayling from streams along the Denali Park Road. However, Kantishna Hills grayling are probably of about average size for grayling from alpine streams in interior Alaska, and considerably smaller than the trophy grayling found in the Bristol Bay region.

Additional studies in the Kantishna Hills should emphasize:

1) Further documentation of aquatic and riparian habitat alteration by placer and lode mining activities; including analysis of turbidity, toxic heavy metals concentratons in water and fish tissues, and changes in stream channel morphology and bottom substrate composition;

2) Collection of data that will be useful in the estimation of stream recovery periods, and that takes into consideration various aquatic habitat types and mining methods;

3) Further investigation of fish distribution, abundance, migration patterns, and spawning and rearing areas in Bearpaw River, Moose Creek, Glacier Creek, Caribou Creek, and several of their key tributaries; and

4) Investigation of the effects of turbidity, sedimentation, and habitat alteration on critical fish life history stages.

APPENDIX XI

Alaska Department of Fish and Game

Field Investigations in the Kantishna Hills,

Denali National Park, 1983

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPARTMENT OF FISH AND GAME

1300 COLLEGE ROAD
FAIRBANKS, ALASKA 99701

October 19, 1983

Ross ~~Kavanagh~~ K.K
U.S. Dept. Interior
National Park Service
Alaska Regional Office
2525 Gambel St.
Anchorage, AK 99503

Dear Ross:

Following is a summary of aerial salmon surveys made of the Bearpaw River drainage by our Department in 1983 as per our memo of understanding.

Three surveys were flown (July 21, August 2, and October 17), the latter two of which were funded by your agency. Results are summarized below as well as on the attached map.

July 21: The mainstem Bearpaw River downstream of Moose Creek was too turbid to survey. Likewise, Moose Creek was unsurveyable due to turbid water. (This survey ended 3-4 miles upstream on Moose Creek.) Twelve live king salmon and one king redd were seen in the mainstem Bearpaw River between the abandoned townsites of Diamond and Glacier. However, only fish in very shallow-water areas along gravel bars could have been seen due to extreme turbidity. It is probable more salmon were present. The Bearpaw River was clear upstream of the confluence of Glacier Creek, and an additional 12 live king salmon were observed between Glacier and Rock creeks. Caribou and Rock creeks were clear, but no salmon were seen. Mining activities on Glacier Creek rendered the stream unsurveyable, and also created the turbidity in the mainstem Bearpaw River downstream of Glacier Creek. This survey was funded by ADF&G.

August 2: The mainstem Bearpaw River was extremely turbid from its mouth upstream to Caribou Creek. Only five live king salmon were seen in this area, and all were between Diamond and Glacier townsites. Six additional live king salmon were observed in clear water upstream of the confluence of Caribou Creek; three were between Caribou and Rock creeks, and three were upstream of the confluence of Rock Creek. Rock Creek was clear, but no salmon were observed. New mining activities on Caribou since the July 21 survey rendered Caribou Creek unsurveyable because of turbid water. Likewise, Glacier Creek was unsurveyable, also due to turbid water resulting from mining on that stream. The mining activities on Caribou and Glacier

creeks resulted in turbid water conditions of the mainstem Bearpaw all the way to the mouth of Moose Creek. Moose Creek was surveyed in its entirety, as well as the North Fork Moose Creek. No salmon were seen. Moose Creek was unsurveyable downstream from Eureka Creek. Turbidity from mining activities was again observed as the cause.

King salmon spawning escapement to the Bearpaw River drainage could not be accurately determined in 1983 due to the direct result of mining operations occuring on Caribou Creek, Glacier Creek, and in the upper Moose Creek drainage. The problem arose from turbidity levels, which in my judgment grossly exceeded State water-quality standards. Several photographs were taken on the two surveys and are on file in the Fairbanks ADF&G office.

October 17: The entire Bearpaw River drainage was surveyed on October 17 for fall chum salmon and coho escapements. With the exception of Caribou Creek, the drainage was clear in water color and only limited amounts of shore ice were encountered. Anchor ice (?) was observed forming in the upper reaches of the Bearpaw River above Caribou Creek, in Rock Creek, Caribou Creek, and the upper reaches of Moose Creek. A total of 505 chum salmon was observed: 218 in the lower 10-12 miles of Moose Creek and 287 (of which one was a carcass) in the mainstem Bearpaw River between the townsites of Diamond and Glacier. The counts are conservative because of severe turbulence affecting observations. Mining-related activities were occurring in only one area. This was observed on Caribou Creek. As a result, Caribou Creek was unsurveyable because of resulting turbid water from this operation.

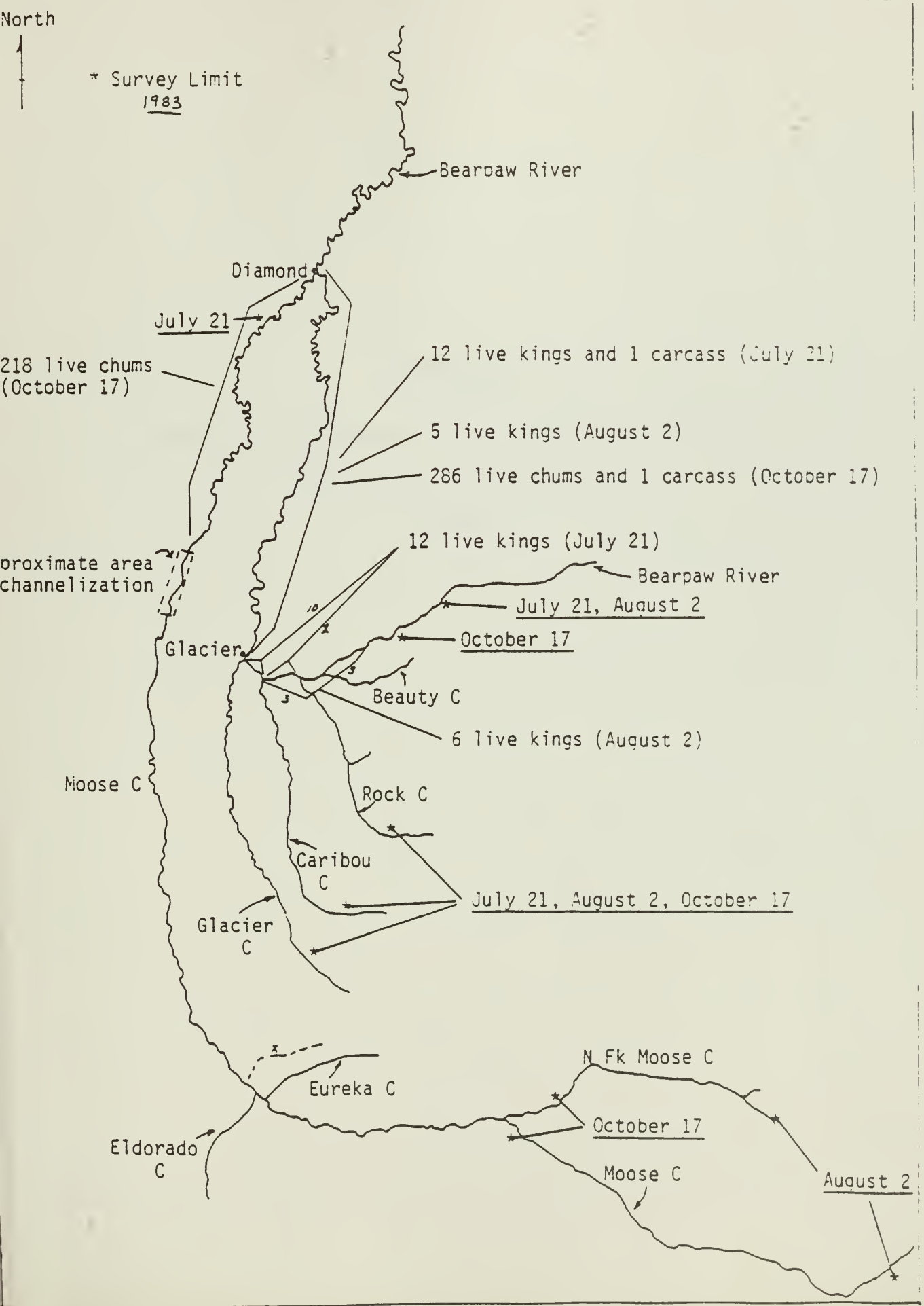
If you have any questions, please give me a call.

Sincerely,

Louis H. Barton
Upper Yukon Research Project Leader
Division of Commercial Fisheries
(907) 452-1531

Attachment

cc: Ron Regnart
Al Townsend - Habitat Division


North
* Survey Limit
1983
Bearpaw River
Diamond
July 21
218 live chums
(October 17)
12 live kings and 1 carcass (July 21)
5 live kings (August 2)
286 live chums and 1 carcass (October 17)
12 live kings (July 21)
Bearpaw River
July 21, August 2
October 17
Glacier
Beauty C
6 live kings (August 2)
Moose C
Rock C
Caribou C
July 21, August 2, October 17
Glacier C
Eureka C
Eldorado C
N Fk Moose C
October 17
Moose C
August 2

APPENDIX XII

Wildlife and the Effects of Mining in the Kantishna Hills

Denali National Park & Preserve

Summary

SUMMARY

Current and historic wildlife use and the effects of mining on wildlife habitat in the Kantishna Hills, Denali National Park, Alaska, were studied between May 16 and August 28, 1983. Wildlife use was determined from available literature, interviews, and surveys of the study area. Comparative study of the effects of mining on wildlife habitat was conducted in a pair of streamside sites, one mined and one unmined.

After 40 years habitat at the mined streamside site had not returned to conditions comparable to the unmined site in terms of moose and breeding bird utilization. Stems of some willow species important to moose were shorter, smaller in diameter, and more widely scattered at the mined site, making them largely unusable as a source of food and cover. Moose utilization as measured by numbers of pellet groups was significantly less at the mined site than at the unmined site. Breeding birds were a quarter as abundant and species diversity was less on transects at the mined site compared to the unmined site. Small mammal trapping results were inconclusive, but other researchers have found smaller populations in mined versus unmined areas, probably because of less understory vegetation. In the Kantishna Hills, percent coverage of understory vegetation was significantly less at the mined site. Natural recovery of placer mined areas to vegetative conditions suitable for natural levels of moose, small mammal and breeding bird utilization probably requires between 70-100 years in the Kantishna Hills.

The Kantishna Hills, particularly the Clearwater watershed, provide important habitat for large mammal populations in Denali National Park. Caribou use the Kantishna Hills, particularly the southern portion, as a pre-rutting and rutting ground, and to a limited extent for wintering and calving. Migration routes cross the study area. There is evidence of greater caribou use of the Kantishna Hills when the herd was larger. Moose are particularly abundant in the Clearwater watershed and the area's density is second only to the far eastern section of Denali National Park. About 50 percent of the moose estimated to live within the range of the Toklat wolf pack are in the study area. Brown bears are common in the Kantishna Hills, which contain the only extensive alpine habitat in the northern additions and black bears are far more common than elsewhere in the old park. Wolves occasionally rendezvous and frequently travel through the study area in search of prey. Active wolf dens are located within 10-15 km of the study area. There are no recent records of Dall sheep in the Kantishna Hills.

At least 18 additional species of mammals, 85 species of birds, and one amphibian occur in the Kantishna Hills but probably reach greater densities outside the study area. No endangered raptor species were observed and only two active raptor stick nests were located. There are no significant densities of waterfowl or other important game birds.

As a Biosphere Reserve, Denali National Park is representative of a functioning subarctic ecosystem. Habitat alternation in one part of the ecosystem, such as the Kantishna Hills, can have repercussions elsewhere. The large mammals in Denali National Park are a worldwide visitor attraction, generating substantial revenues for the State of Alaska.

The severe degree of habitat alteration caused by any large increse in placer mining would likely led to a reduction in moose numbers and to predators that prey on moose such as wolves. Secondary effects associated with an increase in the human population could result in more poaching of large animals, more human/bear conflicts, and a reduction or further reductions in the number of cliff nesting raptors. The proposed Stampede Road, particularly if built along the Clearwater Fork or the mainstem Toklat River, would likely have a severe impact on movements and use patterns of wolves and caribou.

Accelerated revegetation of mined sites should be considered. Replacement of overburden and fines greatly assisted establishment of herbaceous cover in other study areas. Moose seemed most affected of all large mammals by habitat loss, and future work should include additional studies of recovery rates of vegetation, and methods to accelerate recovery of mined sites to increase moose browse supplies.

APPENDIX XIII

Caribou Use of the Cantwell Calving Grounds, Denali National Park and Preserve, Alaska

Conclusions and Summary

CONCLUSIONS AND SUMMARY

Conclusions Relative to Potential Mining

More information is needed on the types and amounts of activity that will potentially occur on the mining claims before the effects upon caribou can be evaluated. In this report we have presented the history of use on the Cantwell calving grounds and caribou distribution during one "typical" year and in a second year of late arrival. This information will be of greatest use once more is known of the level of potential mining activity. We have presented information on how other caribou herds reacted to different types of human activity--some of that information may be directly applicable to the Cantwell calving gronds while in other cases there are differences in the disturbance situation or the background and responses of the different herds.

Some information is available on how the Denali caribou herd reacts to Park road disturbances (Tracy 1977; Singer and Duff, in progress). Our literature review suggests that caribou along the Park road should be less sensitive to disturbance than at Cantewll for the following reasons:

- most road encounters occur later when calves are older,
- insect harassment is more likely along the Park road,
- more tolerant bulls are more common in groups along the road,
- the present road situation has existed since 1972 and is less novel,
- caribou movements tend to parallel the road in a wide intermountain trough and rarely need to intercept the road.

Summary - Caribou on the Cantwell Calving Grounds

1. Aerial surveys were made of caribou distributions on the Cantwell calving grounds in 1981 and 1982. Data from earlier studies, particularly radiotelemetry work from 1976-79, is also presented. We made 1,962 observations of caribou during 8 systematic aerial coverages of the calving grounds.

2. The Denali caribou herd presently numbers only 900-1,200. Numbers were as high as 20-30,000 in 1900-1940, and as high as 7-9,000 as late as 1967.

3. The Cantwell calving grounds is the most significant of 3 calving areas used by the herd. Eleven of 24 (46%) calvings by 10 radio-collared cows occurred at Cantwell, and in an additional 8 cases cows calved elsewhere but traveled within 3 weeks to Cantwell. Groups of mostly cows and yearlings arrive at the Cantwell area in mid-May and usually depart by early to mid-July.

4. In 1981 and 1982 caribou tended to use the areas closer to the Nimbus than the NIM claims, and were closer to both claim areas during calving and immediate post-calving periods (May 20-June 10). After that (June 11-mid-July), caribou tend to drift off of the Dunkle Hills and Camp Creek Flats (and the immediate vicinity of the claims) probably to avoid insect harassment. In years of heavy and late spring snows, Denali caribou calve elsewhere and arrive about 3 weeks late at Cantwell. When this occurs, their distribution at Cantwell is more typically post-calving, i.e., away from the flats and mining claims and into the foothills., We present locations of caribou observations for 2 "typical" calving years (1976 and 1981) and one year of a late spring snow (1982).

5. In 1981, caribou used 4 passes over the Alaska Range to travel to the Cantwell calving grounds. The pass over the limestone claims on the upper West Fork of Windy Creek was the preferred route.

6. A mineral lick in overburden at the old Dunkle coal mine was used daily by caribou in early spring of 1979, but received much less use in the following spring of 1980.

7. Caribou in North America are fairly consistent in their reactions to aircraft overhead, but responses vary a great deal to roads and man-made developments. Group size, time of year, presence of young calves, the presence of less easily disturbed bulls, insect harassment, the motivational drive of caribou on a long migration, the height of facilities and their visual effect--all of these factors may influence how caribou react to an obstruction. Also, the amount of predation and hunting on a herd may affect susceptibility to disturbance.

8. Recent distributions of caribou on the calving grounds and a review of caribou responses to man-made disturbances are presented. It is impossible to evaluate the effects of mining the Dunkle area claims upon caribou until more information is known on the types and levels of potential mining activities.

APPENDIX XIV

Preliminary Research Summary
Cultural Resources Investigations in the Dunkle Mine
and Knatishna Hills Study Areas, Alaska
1982

PRELIMINARY RESEARCH SUMMARY

A survey team consisting of two archeologists and a historian worked approximately three weeks in and around the Kantishna Hills study area during June and August of 1982. Survey time was spent on the ANILCA mandated story of the Kantishna Hills and also involved a much larger area encompassing the Tanana/ Minchumina fire study region.

In addition another team, consisting of two archeologists and a historical architect spent several days in the Dunkle Mine study area during early July.

The ojective of this was to locate, identify, and evaluate archeological and historical sites occurring in each study area, and based upon the later input of post-field planning data on mining development alternatives, assess potential mining impacts upon the cultural resources.

In the Kantishna Hills study area, historical site surveys were conducted primarily by helicopter, with on-the-ground visits made to specific sites if the helicopter was able to land nearby. Archeological site surveys were done using helicopter overflights of areas, but the majority of work was conducted on foot in selected areas deemed to have good archeological site potential. One to three days was spent in archeological site survey of any specific area.

Historical site studies were done primarily on Glacier, Caribou, and Moose Creeks, and at Glacier City and Kantishna. Glacier City is an abandoned mining town located on the Bearpaw River just outside of the study area proper. Kantishna is an active mining community today.

Archeological survey was conducted primarily on Moose and Caribou Creeks and in the Stampede Mine area. A brief survey was also done at Glacier City during the historian's site visit, and one day was spent on the newly constructed "Yellow Creek" mining road located in the Kantishna Hills above the Red Top Mine complex.

In terms of results, no new prehistoric archeological sites were discovered in the study area, but several historic period cabin ruins were identified as potential archeological resources. These include cabin sites in the Stampede Mine area, on Glacier Creek and, in particular, the remains at Glacier City. Of note, the brief survey of the Glacier City area resulted in the identification of three heretofore unknown structural ruins. In terms of archeology, it should be noted that two archeological sites were discovered in the vicinity of mining claims on Rainy and Willow Creeks, tributaries to Moose Creek, in 1980. The sites are lithic scatters located atop knolls and were likely used as game hunting lookouts. The sites, two of only three sites known in the study area, are considered significant.

Historic sites examined in the Kantishna study area in 1982 include those visited briefly in 1980 (including the Busia cabin, Kantishna Roadhouse, Quigley residence, Glacier City, Upper Caribou Creek cabins and wagons), but

also included additional sites such as two cabins located on Glacier Creek, a penstock on Caribou Creek, a cabin on Bear Creek, and selected sites located outside of the study area proper (lower Moose Creek sawmill, McLeod Creek cabin, Slippery Creek cabin, and others). A number of sites located within the study area were noted but not examined. These include cabin ruins on Spruce Creek and the remains of a hydraulic operation on lower 22 Gulch near Glacier Creek. These sites, and others like them, require additional site visits and evaluation.

In the Dunkle Mine area, a historical architect spent one day at the mine complex measuring, photographing, and recording the buildings. The archeological team surveyed portions of the southwestern sector of the study area. The next day the architect accompanied the archeologists on a survey along the Dunkle Mine road which involved sorties to areas of good archeological site potential that were accessible from the road. No prehistoric archeological sites were identified during the survey of the Dunkle Mine study area despite extensive subsurface testing of some very promising areas. Several historic sites were identified, however, in addition to the Dunkle Mine complex. These include a collapsed cache structure (containing old, decomposed sticks of dynamite), the remains of an earth dam, and a large rectangular box that may have been a header for a boomer operation. The dam, cache, and other remains are located a little more than one-fourth mile southwest of the Dunkle Mine airfield. The buildings at the Dunkle Mine complex were not adjudged by the historical architect to be of National Register significance, although the site may justifiably be preserved as a historic site if its importance in relation to Alaska's mining history can be established. It is conceivable that the mine complex could be interpreted to the public as an example of an Alaskan coal mine operation.

Potential Mining Effects

As discussed in the "Overview and Analysis of Mining Effects" report developed by the National Park Service for the Kantishna Hills and Chulitna mining districts (USDI, NPS, 1981), mining and its associated activities are inherently ground disturbing and therefore destructive of cultural resources, be they structures, structural remains, archeological sites and objects. The effects need not be direct. Historic and prehistoric sites in the vicinity of mining claims, along access routes to claims, or in staging areas away from claims could be damaged either inadvertently through mining-related activities, or increased site visitations and removal of structural portions of the sites or objects present. The timely submission of mining plans of operations is an important step in the process of protecting cultural resource sites because the procedure allows time to review the plan and intended mining developments, assess the effects that the operations may have upon archeological or historic sites, and conduct the necessary site surveys if this has not already been done. It is only when the resources and the proposed mining activities are identified that site treatment alternatives, such as data retrieval and recordation or avoidance, for example, can be selected. No cultural resouce site protection strategy will work that does not have the explicit support of all parties involved in both the mining operations and resouces management. Given the fact that many historic sites in mining areas

are directly associated with mining, and have been in the historic past, the mining community should reasonably work for the protection of resources associated with a region's mining heritage.

Refer to the 1981 NPS mining effects report for an expanded discussion of the potential effects mining operations can have on cultural resources.

The general philosophy of cultural resources preservation and treatment within the study area is shaped by these preemptive facts and constraints, as they relate to the built historic environment:

1. Significance: Most of the historic sites are of local significance. In aggregate, they provide a regionally important cross-section of architectural, engineering, and lifestyle patterns in Interior Alaska mining districts.

2. Suitability/Feasibility: Given the remoteness, generally deteriorated condition, predominantly private ownership, and lack of overwhelming significance of the sites, it is not deemed suitable or feasible to expend significant public funds on structural preservation efforts.

3. Location of Minerals: Mining occurs where the minerals are. This means that historic and contemporary mining activities tend to overlap.

4. Historicity and Continuity: In recognized mining districts, ongoing mining activities can be viewed as elements of an evolving historic pattern.

From the commingling of these premises, a preservation and visitor-use program compatible with active mining-district reality can be evolved, along these lines:

1. Architectural, engineering, and historical-archeology recordation of sites, structures, and material culture patterns would be the primary mode of active preservation, along with...

2. Selective Salvage of movable (therefore vulnerable) artifacts for study and interpretive purposes.

3. Passive preservation of structural and engineering remains; in other words benign neglect of decaying fabric rather than active restoration (except for those few structural complexes that might be adaptively used administratively or by visitors--e.g., Stampede Mine, Dunkle Mine), along with...

4. Protection, by the most sensitive siting possible of mining developments and access, to preserve the site integrity of those places and built resources illustrative of mining history.

5. Encouragement, through technical advice and assistance, of preservation efforts by residents of, private owners, and institutions associated with the mining districts.

6. Interpretation and Visitor Use through continued existence of discovery-site historic mining complexes; program and publication based on artifactual, photographic, and documentary collections; and reasonable access to contempory mining activities that illustrate the historic continuum, but with methods and technology.

Protection of the archeological value of prehistoric and recent aboriginal sites and scientific resources must rely on continuing surveys, mitigations, and--as appropriate--salvage in anticipation of ground-disturbing mining activities.

APPENDIX XV

Recreation Potential
Kantishna Hills/Dunkle Mine Study Areas
Denali National Park and Preserve, Alaska
December 1982

RECREATION POTENTIAL: KANTISHNA HILL/DUNKLE MINE STUDY AREAS

Dunkle Mine Study Area - The study area is only several miles from Highway 3, however access is made somewhat difficult by the West Fork of the Chulitna River and its tributary streams, which present a barrier to approaching the study area and the Alaska Range. Between the West Fork and Cantwell there are numerous potential access points, although a number of streams would present some difficulty. The only significant road into the area, the access road from Colorado to the Golden Zone and Dunkle Mines, is currently in poor condition but is being improved. The road is not now open to public use. A few minor roads or trails lead into the edge of the foothills between Summit and Cantwell, to the east of the study area.

The Dunkle Hills are set apart from the Alaska Range, and offer sweeping views of the Alaska Range, Broad Pass and the Talkeetna Mountains to the south and east. The hills are, for the most part, well drained with shallow soils and areas of bare rock, but lower lying areas are poorly drained and spongy. Colorado Creek, a clearwater stream, is cutting an impressive canyon through the western edge of the study area; fishing is reported to be poor in this and other streams in the area. There is currently very little recreation occurring in the study area. However, some hikers do get to the area in the summer and a few skiers and snowmobiles get into the area in the winter. The study area and adjacent lands offer opportunities for hiking, backpacking, wildlife observation, nature photography, and viewing of scenery in an area that is close to the major transportation corridor of the Alaska Railroad and Highway 3. Wildlife in the area appears to be representative of the region, and offers no special recreational opportunities. Caribou migrate into the area; potential conflicts between caribou calving and humans may warrant seasonal restrictions on recreational visitation.

Should the mine access road along the southern edge of the study area be opened to public use, it is probable that the area would become a popular destination. There are several potential sites for campground development in forested areas adjacent to the road. The sites would be in dense vegetation, providing for privacy but requiring careful development. A trail system would be needed to lead visitors out of the forested bottom lands to the higher elevations where hiking is relatively easy. The Dunkle Hills and the Dunkle Mine (if determined worth preserving) would offer pleasant day hike destinations from a campground or trailhead near the present road. The same trailhead could become a popular starting point for extended hikes into the Alaska Range.

Commercial services are limited in the immediate area along Highway 3 but would be expected to increase with the growth of recreational and commercial use and population in the area. As is the case in other areas, if campgrounds or other focal points were to facilitate the congregating of visitors, commercial support services would follow.

Thus, the Dunkle Mine Study Area offers a number of recreational values; with improved access there would be excellent day-use opportunities, and construction of a campground would increase recreational potential. The relatively gentle terrain is ideal for family backpacking experiences, and the area can serve as a threshold to higher terrain and extended backpack trips along the southern edge of the park and across the Alaska Range into the heart of the park. Backcountry camping within the study area is a viable recreational activity, although it may be desirable to limit numbers to protect resources. A seasonal ranger station may be required if visitation mandates a backcountry permit system and/or if a campgound becomes large enough to require a caretaker. This area would likely be used primarily by visitors from Anchorage and Fairbanks. Most visitors from "outside" would likely continue to seek the more spectacular scenic/wildlife areas within the park on the north side of the Alaska Range which offer structured interpretation, transportation services, and diverse accommodations.

Kantishna Hills Study Area - The varied terrain, active mining, privately owned lands and remote location make the study area difficult to analyze. There are numerous unknowns which could effect the recreation potential of the area; mining activity and future access are the major variables.

The primary access is via the park road which is considered at capacity during the peak use season in mid-summer. Unless further research indicates otherwise, an increase in traffic on the park road could have an adverse influence upon the natural behavior and movements of park wildlife. Currently, mining and other heavy traffic has been restricted to nighttime use of the road to minimize conflicts with visitors traffic during the day and to reduce conflicts with wildlife by spreading traffic over a 24-hour period.

The second means of access is by aircraft. The primary landing sites are located at Kantishna and Stampede but a number of additional landing sites are located near mining operations. Winter access is primarily by plane, dog sled, and skis although heavy equipment has been "walked-in" over the frozen terrain. Snowmobiles have been used to some extent. All-terrain-vehicles and other special purpose vehicles have been used for access to mining claims and to a very limited degree for recreational purposes within the area. The Stampede Road from Highway 3 offers access to the eastern edge of the study area. It is in need of extensive repairs and is not, at this time, a viable access route for recreational use of the Kantishna Hills area.

Current recreational uses include backpacking, fishing, wildlife viewing and (to a limited extent) flightseeing from the Kantishna land strip. Many of these activities are organized for the guests of Camp Denali, just outside the southern edge of the study area. The number of backpackers entering the area is relatively small, but is growing. Most arrive by the shuttle bus system that delivers them to Wonder Lake. Recreational gold panning is permissible within the area, although it is totally dependent upon agreement from mining claim operators, as all the easily accessible streams in the Kantishna are presently claimed. Recreationalists must be advised to pan for gold only where they have authoization from claimants to do so.

The area adjacent to Kantishna has been heavily disturbed by mining and there appears to be the potential for disruption of a much larger area. Although there is scattered evidence of early mining activities, much of the historic value has been lost through the influence of modern, high technology mining. Generally, miners do not want visitors on their claims due to safety problems and the potential for vandalism. With increased recreational use, the potential exists for increased friction between miners and visitors. Mining access roads and trails are, in many instances, the logical routes for backpackers seeking to reach the undisturbed areas in the Kantishna Hills. Sportfishing opportunities are reduced by stream turbidity associated with placer mining operations; some streams in the area remain undisturbed.

Interpretation of mining has limited possibilities due to the active mining operations. Although much of the land is in public ownership, the buildings and equipment are, for the most part, privately owned and trespassing on claims is discouraged. The more historic sites (with the exception of some artifacts and structures in Kantishna) are virtually inaccessible to the general public. There is some potential for residents of Kantishna to offer local guided tours and for National Park Service sponsored interpretive programs at the Stampede Mine. The Banjo Mine is probably the most interesting historic resource within the study area. However, it is privately owned, access is difficult, and there are numerous safety hazards. The minor historic sites in the Kantishna Hills could serve as "discovery sites" for hikers and backpackers. Smaller sites would perhaps neither be actively preserved or interpreted, but would be "discovered" by people travelling through the area.

North and east of the mining claim areas are numerous streams, valleys, rolling hills, and high peaks, with vegetative communities ranging from forested drainages to dry alpine tundra. Most of the streams in this area are clear-flowing in contrast to the glacier-fed streams within the old park boundary, and are reported to offer excellent fishing. The relatively gentle terrain offers varied hiking/backpacking routes and excellent campsites.

Wildlife observation, nature photography, sportfishing, and berry picking are the primary recreational values, but the general scenic qualities, vistas of the Alaska Range, and the undisturbed qualities of much of the area are attractions unto themselves. Some of the higher peaks and ridges offer outstanding vistas of Mount McKinley, the Alaska Range, and the McKinley River basin. One of the most outstanding views occurs from the area of 3,744-foot Brooker Mountain west of Kantishna. A rough mining road reaches this area and there is an airstrip that has been used both for mining operations and by guests at Camp Denali. Because of the panoramic view of the Alaska Range, this site is sometimes mentioned as a potential location for tourism development.

For the backpacker or for those who can afford airtaxi service, the Kantishna Hills offer a good recreational opportunity. Some dogsled and cross-country ski trips occur particularly along the southern and eastern edges of the study area, with support services or guided trips available through a park concessioner.

While the Kantishna Hills have good recreation potential, access problems limit their use. While there are numerous areas closer to the main transportation corridor of the Alaska Railroad and Highway 3 offering similar recreation values, none offers the sweeping vistas available from the Kantishna Hills.

There are several possibilities for improving access and recreational opportunities in the study area. The park shuttle system could be extended to the Kantishna airstrip (or even further) but major road improvements including bridges would be required and there could be conflicts between recreational use and mining. Upgrading the Stampede Road would require major bridges and some realignment.

Campgrounds at the road termini in Kantishna and the Stampede area could provide bases for backpackers starting out and for day-use in the immediate area. Commercial ventures offer a number of potentials but cost may be the limiting factor. Drop-off/pick-up services would permit shorter background trips be eliminating the need to return to the park road. These services could be by vehicle on the Stampede Road or aircraft, but vehicle services would depend upon road improvements. Guide services offering full or support services or even seasonal wilderness camps are another possibility.

Alternative access routes to Kantishna have been debated for many years and for various reasons. The concept of a loop road serving the park and/or an alternate road to remove mining traffic from the park road are the major premises for construction of a new road. Some interest in a new road is based on the potential for development of lodging and other commercial facilities in the Wonder Lake/Kantishna area. There are numerous advantages and disadvantages to the loop road concept; cost and impact on wildlife are two major factors that must be evaluated. The National Park Service will be exploring various alternatives and will assess the environmental impacts of these alternatives during the preparation of the general management plan.

The Kantishna Hills area would attract both regional and "outside" visitors. The latter would tend to visit the area when other backcountry units are full and because of a special interest in the historic resources. As the scenic qualities of the area become more widely known, increased visitation could be anticipated. The Kantishna Hills good recreational resources, but expanded mining operations could disturb large areas and consequently the quality of the recreational experience. The remote location will also continue to limit the number of recreational users unless access (by aircraft, roads, or other means) is significantly improved.

APPENDIX XVI

Wilderness Potential
Kantishna Hills/Dunkle Mine Study Areas
Denali National Park and Preserve, Alaska
December 1982

REVISION MAY 1984

WILDERNESS: KANTISHNA HILLS/DUNKLE MINE STUDY AREA

Suitability

The Wilderness Act of 1964 (Public Law 88-577) established a system of designation of Federal lands into a wilderness category: a special, protective status. The Act defined wilderness:

> Sec. 2(c): A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primative and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Given the guidance provided by the Wilderness Act of 1964 and the pertient management policies of the National Park Service relating to wilderness, it is clear that most of the lands of Kantishna Hills/Dunkle Mine Study Areas are technically suitable for designation as wilderness, pursuant to the Wilderness Act. Most lands in the study areas do not bear "the imprint of man's work".

A small percentage of federal lands within the study area has been substantially altered from its natural state or are encumbered by unpatented mining claims, and therefore these lands are not presently suitable for designation as wilderness. These lands are subject to active mining operations and permanent roads primarily serving mining operations.

An Act of Congress is required to designate lands as wilderness. A finding of technical suitability does not mean that lands will be designated as wilderness by Congress.

Dunkle Mine Area

The Dunkle Mine Study Area, with some exceptions, currently meets the criteria for wilderness as described in the Wilderness Act and subsequent interpretations. The Dunkle Mine area is still largely in an unmodified, natural condition with disturbed areas few and relatively small. The road corridor along the West Fork of the Chulitna River, where it skirts the southwest corner of the study area, is an active mine access for the Golden Zone Mine (across the West Fork and outside the park) This active road corridor is not suitable for wilderness designation.

The abandoned road to the Dunkle Mine complex is identified as being suitable for designation as wilderness. This road is not actively used and is becoming overgrown.

Several lode claim groups (NIM, Nimbus, Golder Flower) and placer claim groups (Colorado and Black Bear) are within the study area, and several claim groups lie just beyond the study area. The claims are undeveloped, yet there is the possibility that some or all of the claims may be developed in the future. The lands associated with these claims currently do not meet the criteria for wilderness suitability, because of encumbrance placed upon them by the unpatented claims. Approximately 85% of the Dunkle Mine study area is currently suitable for designation as wilderness.

Kantishna Hills Study Area

Most of the federal lands within the Kantishna Hills study area are undisturbed and uncumbered by mining claims, and therefore meet the criteria for wilderness designation. However, there are numerous lode and placer mines within the southwestern portion of the study area: the eastern and northern portions contain only one recorded mining claim group--The Stampede Mine, which is jointly owned and managed by the University of Alaska and the National Park Service under special stipulations.

Placer claims occupy nearly all the stream bed and surrounding lands of Moose Creek and its tributaries above the Lower Canyon, nearly all of Caribou Creek and several miles of Glacier Creek. Lode claims generally occur in a northeast trending band from Slate Creek to Caribou Creek, although some lode claims are located to the north of this band. There is a mix of developed and undeveloped mining claims in the Kantishna Hills study area, and many old tailing piles are being reworked. Stream beds and gravels in Moose Creek and many of its tributaries have been severly modified by placer mining. Some lode claims have substantially modified landscapes in their immediate vicinity. Mining access roads parallel the creeks mined for placer gold, and other access roads follow higher ground for transport between tributaries and to lode claims.

As with the Dunkle Hill study area there are undisturbed lands that are clearly suitable for designation as wilderness, and there are also developed and disturbed areas that certainly are not suitable for wilderness designation. In the Kantishna Hills study area there are, however, some sites that will have to be judged on a case-by-case basis. Sites that were mined in the past but which are now partly or substantially restored to natural conditions, and tractor trails for access to mining are examples of cases that require further study as to wilderness suitability.

Approximately 70% of the Kantishna Hills study area is currently suitable for designation as wilderness, as defined by the criteria presented in the Wilderness Act of 1964.

Effects of Wilderness Designation on Mineral Development

When an area is designated as wilderness, pursuant to the Wilderness Act, existing rights are retained. Furthermore, wilderness is only designated on Federal lands. Miners having rights to both patented and unpatented (Federal land) claims would retain their rights to operate the claims and to have adequate access to the claims, including access across lands designated as wilderness.

If it is determined that the operation of valid mining claims (including access) is degrading adjoining wilderness resources, and that the degradation exceeds tolerable levels, then attempts may be made to have the method of operation changed to avoid the degradation, or to acquire the claims. In cases requiring acquisition, miners would be provided with fair market value for their claims. Such actions are rare; they require extensive administrative actions and available purchasing funds.

There are not specific differences, either in legislation or regulations, regarding mineral development within designated wilderness lands and parklands where there is no designated wilderness. Wilderness designation is, however an additional factor which park managers consider when opportunities arise for acquisition of mining claims. Park managers will generally give priority lands to designated as wilderness. Although designated wilderness can eliminate the possibility of park development in the form of park-sponsored roads, campgrounds, hotels, etc., wilderness designation does not extinquish existing rights and is therefore a relatively minor factor in determinations on mining claims.

Wilderness: Other Considerations

The General Management Plan for Denali National Park and Preserve is currently underway. A topic to be addressed in this plan is the wilderness suitability of all lands in the park and preserve not presently designated as wilderness: (required by Sec. 1317 of ANILCA) The suitability determinations and possible recommendations resulting from the Kantishna Hills/Dunkle Mine Study could significantly influence the General Management Plan regarding wilderness.

APPENDIX XVII

Summary of Public Comments
Meetings on the Kantishna Hills/Dunkle Mine Study
Draft Environmental Impact Statement
July 11, 12, 13 and 14 1983

SUMMARY OF PUBLIC COMMENTS

The draft environmental impact statement (EIS) on the Kantishna Hills/Dunkle Mine study was distributed to the public in May, 1983. Public meetings were scheduled for mid-July for the purposes of answering questions on the draft EIS, receiving comments on the information and analyses contained in the draft EIS, and receiving comments on public preferences on the future of mining and park administration in the study areas.

A study panel, consisting of representatives from the National Park Service and the Alaska Department of Natural Resources, started the meetings by briefly presenting information on the background of the study and draft EIS, on the mineral resources of the study areas, and on the six alternatives contained in the draft EIS. Following this introduction the meetings were opened to public comment. The entire proceedings were recorded on tape.

A. Anchorage meeting: July 11, 1983

Approximately 70 people attended this meeting.

Summarized comments (in the order presented at meeting):

Resource Development Council: The EIS should address lawsuits over withdrawals in Kantishna, negotiations on lawsuits should be in the EIS, and proposals to settle lawsuits should be in EIS. Kantishna is a valuable mining district. The entire Kantishna area should be put under BLM multiple use management. This would correct an error made within previous withdrawals and ANILCA.

Alaska Center for the Environment: Mining is not a purpose of the park. All claims should be acquired because of destruction by mining of park resources. Acquisition would protect park resources, including caribou, would prevent increase of private lands in the areas, and would allow for increased recreational use.

Marmot Mining: Mining and park uses are compatible due to recent environmental regulations.

Individual: The Kantishna area is torn up by mining. Mining is incompatible with the park.

Alaska Center for the Environment: Mining is severely impacting the Kantishna area. Water quality standards are not being met. Recommends tighter control of mining. Recommends acquisition of mining claims.

Sierra Club: Recommends acquisition of mining claims in order to resolve conflict between mining and park uses.

Individual: There is a natural occurrence of heavy metals. The study areas do not have park values. Recommends removing the areas from the park to resolve conflict.

Sierra Club: The NPS is not managing mining in Kantishna and the unacceptable degradation of resources is occurring. Mining claims should be acquired.

Individual: The Kantishna area has recovered naturally from previous mining. The state needs an economic base. Mining provides jobs.

Individual: Recreation has negative impacts on the park.

Individual: Recreation has negative impacts.

Trustees for Alaska: All claims should be acquired. Until claims are acquired measures should be taken to minimize damage from mining.

Sierra Club: Park resources are on the surface. Unpatented claims should be unable to go to patent and the surface rights on currently patented claims should be acquired. In this way the minerals could be mined out, yet the surface rights would not extend beyond the end of mining.

Individual: The areas have been subject to mining and shouldn't be considered as park values. The areas should be removed from the park.

Marmot Mining: To resolve conflict the areas should be removed from the park.

Denali Citizens Council: Recommends acquisition of mining claims. Compensation would allow miners to continue mining on non-park lands.

Individual: Dunkle is an untouched area. Alternatives should be applied separately to each study area.

C. C. Hawley and Associates: It will be difficult to determine the accuisition cost of mining claims. It will be difficult for Congress for to appropriate money for acquisition of mining claims in the study area.

Alaska Miners Association: Recommends removal of study areas from the park, with access guarantees and boundary revisions from the boundaries presented in draft EIS.

Individual: Mining was in the study areas before they became part of the park. Recommends removal of areas from the park.

Individual: Concerns about adequate management of mining in the Kantishna area should be taken to the NPS.

Individual: Alternatives for acquisition and removal from the park resolve conflict. Acquisition is too costly, therefore, remove the areas from the park.

B. Fairbanks meeting: July 12, 1983

Approximately 25 people attended this meeting.

Summarized comments (in the order presented in the meeting):

Individual: Old mining areas have revegetated and cannot be found. Areas can be mined-out and revert to natural conditions. NPS is the most disturbing influence on caribou in the park due to the number of buses on the park road.

Individual: NPS regulations have run miners out of the Kantishna area and other parts of the park.

Individual: Let existing mining continue but mining should be regulated to protect the environment.

Fairbanks Chamber of Commerce: Mineral information will be limited due to prohibition of drilling off of patented claims. Recommends removing areas from the park.

Alaska Miners Association/Red Top Mine: $1.5 million is not enough money to do a proper study on minerals in the area. There needs to be drilling on more than patented claims. Removal of the areas from the park would rectify a gross error.

Individual: The 1975 EIS shows no caribou in Dunkle study area. NPS studies have disturbed caribou. Recommends removal of Dunkle area from park, with boundary modifications.

Northern Alaska Environmental Center: Haven't found an alternative to support - none with adequate environmental protection and continued mining. Park funds can be better spent than on acquisition of mining claims in the study areas.

Individual: Recommends removal of the study areas from the park because mining is essential to Alaska.

Individual: Recommends removal of the study areas from the park because of need for mining in U.S.

Individual: The resources in the Kantishna area are being destroyed by mining. Need to clean up the mining area.

Individual: Recommends removal of areas from the park.

Alaska Miners Association: Recommends removal of the areas from the park, with boundary modification from draft EIS. This would eliminate conflicts. Mining provides tourist attraction. Funding is inadequate for minineral studies, and no drilling beyond patented claims does not allow for proper evaluation of minerals.

Individual: Remove Dunkle area from park but revise boundary lines from those presented in draft EIS. Mineral studies will be inadequate.

Individual: Mineral studies will be inadequate. Remove areas from the park but do not add lands to the park by exchange.

C. Healy meeting: July 13, 1983

Approximately 15 people attended this meeting.

Summarized comments (in the order presented at meeting):

Individual: Allow recreational mining by small dredge. Remove areas from the park.

Citizen Advisory Commission on Federal Areas. Perhaps investigate not giving patent to unpatented claims in order to allow mining but avoid later title to the surface.

Indivdual: Recommends alternatives 5 (increased mineral development or 6 (removal from park).

Individual: Recomends alternatives 5 or 6 because of need for industry in Alaska. Transportation corridors are needed.

Individual: Recommends removing areas from park, but with no exchange. There is too much wilderness.

Individual: Alternatives 3 seems fair to miners (25 year operating rights.)

Individual: Who would do reclamation under alternatives 2 and 3 status quo and acquisition).

Individual: Remove areas from the park and build Stampede Road.

Individual: Remove areas from the park.

D. Kantishna meeting, July 14, 1983

Approximately 100 people attended: most were claimants and operators in the Kantishna area.

Summarized comments (in the order presented at meeting):

Individual: The Kantishna area was not in the park until recently. Alternative 4 (additional time to perfect) would be too costly for claimants. Alternative 3 (25 year operating right) would lead to ecological destruction due to intensive mining. Mining has not caused significant disturbance: some previous mines can't even be found today.

Individual: There would be more mining if there had not been withdrawals. Park should be abolished.

Individual: If claims are bought out, there had better be fair prices paid.

Individual: NPS is not qualified to manage mining. Remove the areas from the park but with no land exchange. The other alternatives are unacceptable.

Individual: Wants to work with NPS and continue mining. A new road should be built to Kantishna.

Alaska Miners Association: The current validity process is in error and needs to be revised.

Individual: Removal of the areas from the park is the only viable alternative, because mining requires ground disturbance and is not compatible with the park.

Individual: Remove areas from park.

Individual: Mining and parks are not compatible.

Individual: Comment period should be extended and the study group should meet in Kantishna.

Individual: Removal of the areas from the park would correct a wrong done by ANILCA. Stampede Road should be built to Kantishna. Water quality studies are not being scientifically conducted.

Individual: There is natural revegetation of mined areas.

Individual: Remove areas from the park. Mining creates historic resources.

Alaska Miners Association: Protest prohibitions of drilling beyond patented claims.

Many attendees at the Kantishna meeting wanted the following statement in the summary of public comments: "Virtually everyone at the meeting favors removal of the study areas from the park." The study panel agreed to have this statement entered in the summary and agreed that the statement accurately represented the preferences of the public at the meeting.

Tabulation of expressions of preference for Alternatives

Anchorage meeting
    6 people expressed preference for Alt. 2
    7 people expressed preference for Alt. 6

Fairbanks meeting
    1 people expressed preference for Alt. 1
    9 people expressed preference for Alt. 6

Healy meeting
    1 people expressed preference for Alt. 3
    5 people expressed preference for Alt. 6

Kantishna meeting
    virtually everyone expressed preference for Alt. 6

Alternative 1: Maintain Status Quo
Alternative 2: Acquire All Mining Claims
Alternative 3: Offer Term Operating Rights
Alternative 4: Allow Additional Time For Perfecting Claims
Alternative 5: Expand Mineral Development
Alternative 6: Remove Mineralized Areas From the Park

APPENDIX XVIII

Summary of Agency Comments on Study
Study Group Recommendations

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

MEMORANDUM

State of Alaska

TO: Kantishna Hills/ Dunkle Mine Study Group

DATE: November 17, 1983

FILE NO:

FROM: Shaun Sexton, Environmental Engineer

TELEPHONE NO:

SUBJECT: Recommendations Preferred Alternative

Alaska Department of Environmental Conservation - Preferred Alternative for Management of the Kantishna Hills Study Area

Based upon the results of quantitative and qualitative information obtained through numerous routine and investigative visits to placer mining operations in the Kantishna Hills study area during the past three mining seasons it is apparent that state Water Quality Standards and Waste Disposal Permit stipulations are being exceeded, as a result of placer mine wastewater discharges, to levels which are greatly in excess of those which are attainable. In spite of an active technical assistance and compliance - by - cooperation approach to improving the water quality conditions in this area, there continues to be a lack of consideration for wastewater treatment system design and maintenance on the part of many of the mine operators. Although several of the operators have made commendable efforts to install and maintain sedimentation basins, others continue to wait until prompted to do so by regulatory agency personnel. The sedimentation ponds observed during site investigations have not been adequately designed or maintained. In addition no attempt has been made, on the part of any mine operator, to implement the use of other available methods which would reduce wastewater discharge including, wash water recirculation. Furthermore, quantitative analysis of the water quality data obtained during this study combined with observations of the terrain and topography indicate that compliance with all of the state Water Quality Standards will be difficult, if not impossible, on many of the streams in this area which receive placer mining wastewater discharge. On many of these streams there is insufficient space available for installation of adequtely sized and appropriately designed sedimentation basins which are typically the key component of any wastewater treatment system. Even though many of the wash plants employed by the mine operators in this area are relatively low water volume users, their discharges have resulted in water quality alterations in extreme excess of applicable regulations. Based on a continuation of current practices, it must be expected that excessive water quality alterations will continue in the future even if other available treatment methods are attempted.

Therefore, a vote for the selection of any of the alternatives proposed by the Draft Environmental Impact Statement, other than alternative two, would be an acceptance, on the part of this Department, of continued non-compliance with the State Water Quality Standards. In other words, if placer mining continues in the Kantishna Hills then water quality alterations in excess of the allowable limits will result unless some strong measures are taken which are not now in force. Subsequently, the only alternative available which will assure absolute compliance with the state Water Quality Standards is alternative two, "Acquire All Mining Claims".

Realizing that this may not be a realistic alternative, and considering that alternatives 4,5, & 6 would also require special legislative action, a more appropriate choice among the proposed alternatives, would be Alternative One, "Maintain Status Quo". However, this alternative would only be conditionally acceptable. That is, special provisions would need to be made, and steps taken by the National Park Service, the regulatory agencies, and the mine operators which would accelerate attempts at compliance with the current regulations. Such provisions would need to include a more detailed wastewater treatment system design and approval procedure such as the procedure required under 18 AAC 72, Wastewater Disposal, which requires written approval of engineering plans by this Department prior to operation of a non-domestic wastewater disposal system. In addition, routine inspections by the National Park Service, and the regulatory agencies would need to be more frequent and submittal of operator maintained "self-monitoring" results would be necessary. This would require that the National Park Service, as the Land Manager, specify required technology/best management practices and establish a compliance schedule. This would likely require partial or complete recycling and those operators who can't comply would phase out during the compliance period.

Even so, since compliance with all state Water Quality Standards could not be anticipated under Alternative One, a decision on a definition of an "acceptable level" of water quality alterations would need to be made so that definite criteria for the design of wastewater treatment/disposal systems would be available. It must be realized that, due to natural constraints, installation of treatment systems capable of meeting even a "relaxed" water quality standard or effluent limitation would not be possible on all the streams in this area. Consequently, gravel washing activities would need to be limited to areas where adequate wastewater treatment systems could be installed and maintained.

Assuming that agreement can be reached, which guarantees that every effort will be made to gain compliance with established water quality regulations, then alternative one would be an acceptable alternative. However, there is no evidence to date indicating that such an agreement will be made and carried-out. The primary responsibility would reside with the National Park Service to establish the technology applications and enforce an appropriate compliance schedule.

SS/mn

cc: Keith Kelton
Bob Martin
Joe Cladouhos
Dan Wilkerson

KANTISHNA HILLS STUDY AREA

Alaska Department of Fish and Game

The Alaska Department of Fish and Game (ADFG) supports and concurs with the recommendations as made by the study team for the Kantishna Hills area with the exception of expanded placer sites on streams which drain into the Toklat River. Based on a historical knowledge of placer mining and current state of art methods and procedures for ensuring compliance with existing water quality standards, we cannot support, at this time, an expansion of placer mining into tributary streams of the Toklat River.

The Toklat River has the largest known population of fall spawning chum salmon in Alaska and is estimated to contribute over 34% of the commercial and subsistence fall chum salmon harvest in the Yukon and Tanana River fisheries downstream of the mouth of the Kantishna River. Escapement indexes of spawning fall chum salmon in the Toklat River have ranged from 14,000 to 96,500 during the period from 1973 to 1982. In the last five years, an average of 149,000 Toklat River fall chum salmon have been harvested annually by the commercial and subsistence fisheries. This represents a direct average value to the commercial fishermen of over $630,000 annually and a estimated replacement cost value for the subsistence fisheries of nearly $870,000.

Toklat River fall chum salmon provide the mainstay winter food supply for a significant portion of the grizzly bear population of the Kantishna drainage; many of these grizzly bears migrate as far as 60 miles to feed on the salmon spawning stocks. The spawning area also supports a large population (500 to 600) of overwintering mallards which is believed to be the northernmost sizeable concentration located in North America. In addition the area supports large numbers of wolves, foxes, coyotes, bald and golden eagles, ravens, owls, river otters, and mink which are attracted to the springs to feed on the spawning salmon.

Alvin G. Ott, Regional Supersivor
Habitat Division
Alaska Department of Fish and Game

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503
(907) 276-3800

IN REPLY REFER TO:
DTS

18 NOV 1983

Linda Nebel
Chief of Division Planning
U.S. National Park Service
2525 Gambell Street
Anchorage, Alaska 99503

Dear Ms. Nebel:

A request was made of our agency as a member of a National Park Study Team to select, by vote on November 17, 1983, one of the alternative actions listed in the Draft Environmental Impact Statement dealing with the Denali National Park and Preserve, Kantishna Hills-Dunkle Mine area. As a result of our studies in the area, our preference is Alternative 2 - Acquire all Mining Claims. By accepting this alternative, adequate protection of the fish and wildlife resources would be assured to a larger degree than offered by any of the other alternatives. We are unable to state what the value of fish and wildlife resources might potentially be with the limited investigations conducted. Realizing that Alternative 2, because of economic values of the area, may not be practical, we favor Alternative 4, Allow Additional Time for Perfecting Claims, as a second choice, and as a third choice, selected Alternative 1, Maintain Status Quo (No Action). We believe the important resources of the area can be protected and the mineral wealth be developed if regulations and proper stipulations are strictly applied. Probably most important is that adequate funds be provided for administering the 5-year exploration and discovery period. Also, important to the plan would be resource studies for determining resource protection requirements and making final recommendations for them to the National Park Service (NPS). Water quality standards must be stringently enforced by all mining operations conducted in the area. Our investigations of water quality and heavy metals in fish tissues substantiate that the area is naturally highly mineralized with various metals. Land disturbance would elevate the levels of heavy metals in the aquatic ecosystem, likely exceeding established State and Federal water quality standards.

We view this highly mineralized area to be extremely complex and possibly difficult to administer in view of the various multi-placer and lode deposits of heavy metals such as gold, silver, lead, and antimony. We realize that other important minerals may be added to this list in the future. However, the Bureau of Mines, as a result of their 1-year intensive investigations, estimated the value of these four metals in the area at nearly 3/4 of a billion dollars, indicating the economic importance of the area.

Even though we realize that the area has a number of inherent management problems, we believe they can be satisfactorily handled for resource protection.

We would hope some of the important aspects indicated in Alternative 1 might be carried over to Alternative 4:

1. "Mineral development and mining activities would continue to be managed under existing NPS authorities and regulations, general and specific park stipulations, and normal permitting and approval requirements of other regulatory agencies."

2. "These activities, including adequate and feasible access, would continue to be subjected to approval of mining plans of operations, with regard to protection of significant natural and cultural resources and other park values, and to a determination of claim validity."

Alternative 4 carries most of the mining provisions under which the Fish and Wildlife Service operates its National Wildlife Refuges, with the exception of the 5-year plan in which to explore and achieve a valid mineral discovery. Since the Department of Interior is currently working under very nearly similar requirements on this alternative, it was elevated to a second choice position.

Alternative 1 holds most of the key points necessary to allow mining and protection of the other resources important to the purpose of having the park and to administering it. Reaching a final decision was difficult, since the two alternatives are nearly identical in the sense of allowing mining.

We appreciate the opportunity provided by the NPS for allowing us to express the position of the Fish and Wildlife Service on this difficult decision to be made on an important land area.

Sincerely,

Howard Metsker

Howard Metsker
National Park Service Study Team Member

United States Department of the Interior

NATIONAL PARK SERVICE

IN REPLY REFER TO:
D18(ARO-PPD)

NOV 22 1989

Bill Beatty and David Hedderly-Smith
State Study Co-Chairs
Kantishna Hills/Dunkle Mine Study
Alaska Department of Natural Resources
555 Cordova Street
Anchorage, Alaska 99510

Dear Mr. Beatty and Mr. Hedderly-Smith

The National Park Service supports Alternative #1 in the draft environmental impact statement for the Kantishna Hills and Dunkle Mine study areas of Denali National Park and Preserve. This alternative allows the continuation of mining on valid, existing claims within the two study areas under the jurisdiction and management of the National Park Service as well as being subject to other applicable federal and state regulations. Alternative #3 also appears to provide a system that allows continuation of mining (for a definite period) and environmental monitoring and control.

There are presently 161 unpatented and 2 patented placer claims and 92 unpatented and 37 patented lode claims in the Kantishna Hills study area. All of these claims are currently available for mineral development at the claimant's discretion, and subject to approval of a plan of operations. These claims cover much of the proven and more highly mineralized lands within the study area. Ten to 15 placer gold operations have been conducted in the area in the past several years, and one or two very small scale lode gold/silver/antimony operations have been conducted during this same period. Most of the unpatented and patented lode claims have not been worked for more than 40 years.

Mineral deposits do exist beyond existing claims. Yet, until mining becomes economically feasible on existing lode claims and development is proceeding, it is unreasonable to consider making additional lands available to mineral development within this National Park which is closed to mineral location and entry and leasing by legislation.

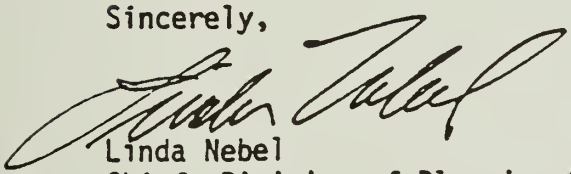
The northern additions to the former Mt. McKinley National Park were established by Congress primarily to protect the park's populations of caribou, moose, bear and wolves and their habitat. Allowing additional lands to be subject to mineral development would negatively affect these populations. Besides the direct impacts of mineral exploration and development, the potential for negative impacts upon wildlife from mining traffic, additional settlement and new access corridors is of great concern to the National Park Sevice.

Two clearwater drainages are currently being affected by placer mining with some degradation of water quality, fisheries, scenic values and wildlife habitat. The other major clearwater drainage in the Kantishna Hills, the Clearwater Fork of the Toklat River, remains in a natural condition, with minor exceptions. The only possible mining in this drainage is on the claims at Stampede, which may only be used for educational purposes under an agreement with the University of Alaska. The Clearwater Fork has important values in wildlife and fishery habitats, wildlife movement routes and recreational opportunities. The National Park Service particularly opposes mineral development in this drainage.

The Dunkle Mine study area, on the southern flanks of the Alaska Range, lies within a principal calving ground of the Denali caribou herd. This herd is currently at a very low level (approximately 1000 animals), and may be vulnerable to further declines. At a larger herd size, the Dunkle Mine area may be even more important to caribou use. It is the position of the National Park Service that a very conservative approach should be taken regarding management of this herd. This portion of the calving ground should remain within the park, and human activities on the calving ground should be closely monitored and controlled, so as to avoid any disruptive influences on this herd. The Denali caribou herd is a very important wildlife component of Denali National Park and Preserve, and is the most viewed caribou herd in the world.

Accordingly the National Park Service supports Alternative #1 for both study areas within Denali National Park and Preserve.

Sincerely,



Linda Nebel
Chief, Division of Planning & Design

EDITOR'S NOTE: The alternatives referred to in this letter correspond to the alternatives in the draft EIS. Alternative 1 in the draft EIS provided for "status quo" management of mining claims, and alternative 3 provided for "term operating rights" for claimants. Alternatives in the final EIS and study report have been assigned new numbers.

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